

APPENDIX E

PHASE I STREAMLINED ECOLOGICAL RISK EVALUATION

Appendix E

DRAFT Phase 1 Streamlined Ecological Risk Evaluation

Engineering Evaluation/Cost Analysis OU2 OU3 Richardson Flat Tailings Site

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Prepared for:

**United Park City Mines Company
P.O. Box 1450
Park City, UT 84060**

**Prepared by:
Alpine EcoSciences
Golden, CO 80401**

Contents

1	Introduction.....	E-1
1.1	Approach.....	E-2
1.2	Site Description and Habitats.....	E-3
1.3	Preliminary Ecological Conceptual Site Model	E-4
1.3.1	Aquatic Pathways.....	E-5
1.3.2	Terrestrial Pathways.....	E-6
2	Data Used for Risk Assessment.....	E-6
2.1	Surface Water Data	E-6
2.2	Sediment Data	E-7
2.3	Surface Soil Data.....	E-7
3	Identification of Chemicals of Potential Concern.....	E-8
3.1	Surface Water Screening.....	E-8
3.2	Sediment Screening.....	E-11
3.3	Surface Soil Screening	E-11
4	Summary of Results.....	E-13
5	Conclusions.....	E-13
6	References.....	E-15
	Appendix E Figures and Tables	

Attachment E1, U.S. EPA Region 8 Selection of Toxicity Benchmarks for Ecological Receptors

List of Tables

Tables are found in a section following the text.

- Table E-1. Screening results for surface water samples compared with National Recommended Water Quality Criteria for Aquatic Life
- Table E-2. Screening results for surface water samples compared with aqueous screening benchmarks for amphibians
- Table E-3. Screening results for sediment samples compared with sediment toxicity benchmarks for benthic macroinvertebrates
- Table E-4. Screening results for soil samples compared with benchmarks for effects to soil invertebrates and plants (sheets a through d)
- Table E-5. Screening results for soil samples compared with Eco-SSLs for effects to wildlife (sheets a through d)

1 Introduction

This document presents the preliminary identification of contaminants of potential ecological concern (CoPCs), which is the first phase (Phase 1) of the streamlined ecological risk evaluation that is being performed as part of the Engineering Evaluation/Cost Analysis (EE/CA) at Operable Units (OU) 2 and 3 of the Richardson Flat Tailings Site in Park City, Utah (the Site). United Park City Mines Company (United Park) is conducting this work pursuant to an Administrative Settlement Agreement and Order on Consent for an EE/CA Investigation and Removal Action, dated March 6, 2014, U. S. EPA Docket No. CERCLA-08-2014-0003 (the AOC). The work was performed in accordance with the EE/CA Work Plan and Sampling and Analysis Plan (SAP) that was prepared by Resource Environmental Management Consultants (RMC) for United Park.

The ultimate goal of the streamlined ecological risk evaluation is to determine the level of risk posed to ecological receptors by the contaminated media present at the Site, and to determine if a response action is required to address these risks (RMC 2014). The objectives of the Phase 1 streamlined ecological risk evaluation are to 1) determine if data are adequate to address ecological risks and 2) identify ecological CoPCs, based on a screening of available site data against default screening benchmark values. This Phase 1 streamlined ecological risk evaluation is being conducted in accordance with U.S. EPA's 1993 *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA*, and EPA's 1997 *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*. U.S. EPA's 1997 guidance provides an eight-step process, with Step 1 being the Screening-Level Problem Formulation and Ecological Effects Evaluation, and Step 2 being the Screening-Level Exposure Estimate and Risk Calculation. The scientific/management decision point at the end of the Step 1 and Step 2 process is to determine if (U.S. EPA 1997):

1. There is adequate information to conclude that ecological risks are negligible and therefore no need for remediation on the basis of ecological risk;

2. The information is not adequate to make a decision at this point, and the ecological risk assessment process will continue to Step 3; or
3. The information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.

1.1 Approach

According to U.S. EPA's 1993 *Guidance on Conducting Non-Time Critical Removal Actions*, a streamlined risk evaluation is intended to be intermediate in scope between a limited risk evaluation undertaken for emergency removal actions and a conventional baseline risk assessment normally conducted for remedial actions. A streamlined risk evaluation can help justify undertaking a removal action, and identify what current or potential exposures should be prevented. The results of the OU2/3 streamlined risk evaluation can be used to determine whether a cleanup action is necessary to address ecological risk and what exposures need to be addressed by the action.

Phase 1 of the streamlined ecological risk evaluation is the preliminary identification of ecological CoPCs. The data for surface water, sediment, and surface soil are screened against ecological risk-based benchmark values to identify the CoPCs. Chemicals that are essential macronutrients (calcium, iron, magnesium, potassium, and sodium) that are present at low concentrations (e.g., only slightly elevated above naturally occurring concentrations or within the range of recommended nutritive levels¹), and major anions measured to assess water/soil quality (alkalinity, total chloride, nitrate-nitrite, sulfate, and phosphate) are not included in the screening. Data for these chemicals can be used later in the risk assessment process, where appropriate, to make inferences regarding soil/water quality and chemical bioavailability. Chemicals that were not detected in any sample are also eliminated from further assessment in the screening process. Detected chemicals without ecological screening values cannot be eliminated in the screening process and are also retained as CoPCs.

¹ Region 8, U.S. EPA Technical Guidance. Evaluating and Identifying Contaminants of Concern for Human Health. SOP#8RA-03. September 1994.

1.2 Site Description and Habitats

The site description and background information are provided in Section 1.1 of the EE/CA Site Characterization Report. The Site is composed of Lower Silver Creek, the Middle, Floodplain Tailings, and State Route 248 Reaches of Silver Creek and the P.C. West and P.C. East areas. Silver Creek and the adjacent floodplain receive water from sources that include precipitation (primarily snowmelt), groundwater, springs, and urban runoff. The contaminants of interest are heavy metals derived from historic mining and milling operations that occurred throughout the Silver Creek watershed; these operations deposited large quantities of tailings in the floodplain of Silver Creek throughout OU2 and OU3. Limited areas of contaminated soils are also known to exist in upland areas of OU2 and OU3 as a result of historic water diversions and irrigation activity. Known and potentially contaminated media include soil, sediment, groundwater and surface water. In regards to surface water, the Silver Creek watershed has been included on Utah's 303(d) lists as impaired since 1998 with a high ranking due to elevated levels of cadmium and zinc, and a total maximum daily load for dissolved zinc and cadmium was completed in 2004. The watershed is classified as a 3A—Cold Water Fishery, 1C—Domestic Water Supply, and 4—Agriculture.

Those areas of the Site that do not support habitat (e.g., bare tailings, bare soil, gravel, paved areas, or otherwise disturbed areas) or that do not have complete exposure pathways to ecological receptors can be eliminated from further assessment in ecological risk assessment process (U.S. EPA 2015a). Per the U.S. EPA Region 6 Ecological Exclusion Criteria Worksheet, general information about the Site, its physical characteristics, ecological habitats and receptors, can be used to identify incomplete or insignificant exposure pathways, thus eliminating the need for further ecological evaluation at these areas (U.S. EPA 2015a). According to the worksheet, property “wholly contained within contiguous land characterized by: pavement, buildings, landscaped area, functioning cap, roadways, equipment storage area, manufacturing or process area, or other surface cover or structure, or otherwise disturbed ground” meets the exclusion criteria. Areas that are bare soil or tailings meet these criteria, and are also “not attractive to wildlife or livestock, including threatened or endangered species; these areas do not serve as valuable habitat, foraging area, or refuge for ecological communities” (U.S. EPA 2015a).

Therefore, areas of disturbed ground including tailings can be excluded from further ecological evaluation. Any exposure experienced by wildlife on these highly disturbed areas would most likely be incidental and brief, and would likely occur while animals are passing through to access other areas of more suitable habitat for foraging, breeding, or refuge.

1.3 Preliminary Ecological Conceptual Site Model

The Field Sampling Plan (FSP, RMC 2014) provided a preliminary identification of potential receptors, and assessment and measurement endpoints for the streamlined ecological risk evaluation. Potential ecological receptor groups (and their ecological risk management goals assessment endpoints/) include:

Receptor Groups	Risk Management Goals	Assessment Endpoints
Fish community	Maintain a self-sustaining fishery in Silver Creek	Survival, growth, and reproduction of aquatic life as represented by fish populations
Benthic invertebrates	Maintain the benthic community in Silver Creek	Survival, growth, and reproduction of aquatic life as represented by benthic invertebrate populations
Amphibians	Maintain self-sustaining amphibian populations	Survival, growth, and reproduction of amphibians
Aquatic-dependent avian community	Protect aquatic-dependent avian populations and their habitats	Survival and reproduction of aquatic-dependent avian wildlife populations
Upland avian community	Protect upland avian populations and their habitats	Survival and reproduction of upland avian wildlife populations
Mammalian wildlife receptors	Protect mammalian wildlife populations and their habitats	Survival and reproduction of mammalian wildlife populations

A conceptual site model (CSM) is a planning tool used for identifying chemical sources, potentially affected environmental media, complete exposure pathways, and potential receptors on which to focus the risk assessment. The preliminary ecological CSM (Figure E-1) describes the network of relationships among chemicals released from the Site and the ecological receptors (plants and animals) that may be exposed to them through pathways such as contact with contaminated media or ingestion of contaminated food or water. The CSM examines the range of potential exposure pathways and identifies those that are present and may be important for ecological receptors, and eliminates those pathways that are incomplete or insignificant and therefore are not subject to further consideration in the ecological risk assessment process.

A complete exposure pathway consists of the following four elements (U.S. EPA 1997):

1. A source;
2. A mechanism of release, retention, or transport of a chemical to a given medium (e.g., sediment, water, soil);
3. A point of contact with the medium (i.e., exposure point); and
4. A route of exposure at the point of contact (e.g., incidental ingestion, direct contact).

If any of these four elements is missing, the pathway is considered incomplete (i.e., it does not present a means of exposure). Only those exposure pathways judged to be potentially complete are of concern and require evaluation in a risk assessment. The CSM (Figure E-1) describes possible sources and transport mechanisms of constituents from the Site into surrounding ecosystems, and the pathways by which ecological receptors may be exposed. The CSM was developed based on the Site history, Site conditions, prior investigations, and the results of available sample analyses.

The Site-related sources of contaminants are fugitive dust, contaminated soil, aqueous discharge, tailings, and other waste from historic mining operations. Metals and other constituents can be released from these sources via the transport mechanisms of wind and aerial deposition, surface-water runoff and soil erosion, sedimentation, and leaching to groundwater. Once released to the environment, some of the chemicals may become dissolved or suspended in surface water, co-deposited with or adsorbed to sediments, incorporated into soil, or leached into groundwater, and potentially can enter the food web through uptake into plants and prey, which then could be consumed by upper-trophic-level ecological receptors. Additionally, exposure to naturally occurring elements is likely throughout the area, through the pathways described above.

1.3.1 Aquatic Pathways

Surface water and sediment may be affected by direct discharge, surface runoff, and potentially groundwater discharge to surface water. Aquatic ecological receptors can be exposed to CoPCs through contact with and ingestion of surface water, near-bottom water, sediment, and sediment

pore water; and through ingestion of tissues of other organisms. Aquatic ecological receptors (primarily benthic invertebrates and fish in Silver Creek) may come in direct contact with chemicals in sediments and surface water, and indirectly through the ingestion of contaminated aquatic plants or prey. Wildlife that use Silver Creek and floodplain wetlands for loafing and foraging areas may be exposed to chemicals in sediment via incidental ingestion, and may also ingest contaminated food items and water.

1.3.2 Terrestrial Pathways

For terrestrial plants, the primary pathway is the uptake or absorption of metals incorporated into soil. Soil fauna (represented by soil invertebrates) may also be exposed to metals through direct contact with the soil. In addition, terrestrial wildlife receptors can be exposed to contaminants via both terrestrial and aquatic pathways through the ingestion of soil and/or sediment during foraging or preening, or consumption of contaminated terrestrial plant material, terrestrial prey, or aquatic organisms (e.g., fish; invertebrates); dermal contact with surface water and soil or sediment; and ingestion of contaminated drinking water. Direct contact with sediment and surface water is a potential exposure pathway for wildlife receptors, but this route is insignificant relative to the ingestion route.

2 Data Used for Risk Assessment

Sampling events that provide data for the streamlined ecological risk evaluation are summarized in Table 2-1 from the EE/CA Site Characterization Report.

2.1 Surface Water Data

Surface waters present in OU2 and OU3 are primarily related to Silver Creek. Silver Creek and the adjacent floodplain receive water from sources including but not limited to precipitation, groundwater, springs, and urban runoff. The primary groundwater contributor to Silver Creek is the Dority spring, located north of Prospector Square. The headwaters of Silver Creek are located in Ontario and Empire Canyons.

Surface water samples were collected quarterly from November 2014 to October 2015 to characterize Silver Creek, tributaries, and other inflows/effluents in OU2 and OU3. Surface water samples were collected from twelve locations within OU2 and seventeen locations within OU3. Refer to the EE/CA Site Characterization Report Figure 1-2 (sheets 1 through 4) for the surface water sampling locations. Surface water samples were analyzed for total and dissolved inorganic constituents (metals) and general water chemistry including hardness, phosphate, total suspended solids (TSS), nitrate, chloride, sulfate, alkalinity, and total dissolved solids (TDS) (refer to Table 2-3 from the EE/CA Site Characterization Report). Field water quality parameters are presented in the EE/CA Site Characterization Report Table 2-4, and flow measurements are presented in Table 2-5.

The streamlined ecological risk evaluation uses the dissolved metals concentrations to characterize exposure for aquatic receptors (i.e., benthic macroinvertebrates and fish) in accordance with the U.S. EPA's recommended aquatic life ambient water quality criteria developed under Section 304(a) of the Clean Water Act.²³

2.2 Sediment Data

Fourteen sediment samples were from sample locations co-located with Silver Creek surface water sampling locations in November 2014, and July, August and September 2015. Sediment samples were collected from five locations in OU2 and nine locations in OU3. Sediment samples were analyzed for metals, phosphorus, and percent moisture. Sediment sample analytical results are presented in the EE/CA Site Characterization Report Table 2-10. The sediment sampling locations are shown on EE/CA Site Characterization Report Figure 1-5.

2.3 Surface Soil Data

Soil samples were collected intermittently from November 2014 to October 2015 and were analyzed for metals, phosphorus, and percent moisture, as presented in EE/CA Site

² <https://www.epa.gov/wqc/aquatic-life-ambient-water-quality-criteria>

³ <https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table>

Characterization Report Table 2-9. For the purposes of the streamlined ecological risk assessment, surface soil is considered the relevant exposure pathway characterized by samples that were collected from depths of 0 to 1-foot. Refer to EE/CA Site Characterization Report Figure 1-4 for the soil sampling locations.

3 Identification of Chemicals of Potential Concern

Site data for chemicals present in surface soil, sediment, and surface water were screened to identify CoPCs for ecological evaluation. The intent of the CoPC screening is to focus the risk assessment on chemicals at the Site that have the greatest potential to contribute to ecological risk. The result of the CoPC screening is the identification of a Site-specific list of chemicals on which the remainder of the ecological assessment process can be focused.

The data screening was accomplished by comparing detected chemical concentrations in surface water, sediment, and surface soil with available and appropriate ecological risk-based screening benchmarks. The benchmarks used for the screening were provided by U.S. EPA Region 8 (screening benchmark tables entitled *Selection of Toxicity Benchmarks for Ecological Receptors* are provided in Attachment E1).⁴ Chemicals that are present in surface water, sediment, and surface soil at concentrations that exceed the screening benchmarks, bioaccumulative and persistent chemicals, and chemicals for which no screening values are available, were identified as CoPCs. For all media, duplicate samples were averaged using one-half the detection limit for non-detects, and non-detected results are reported at one-half the detection limit.

3.1 Surface Water Screening

The surface water criteria for aquatic life provided by U.S. EPA Region 8 (Attachment E1) were out of date and were updated using the most recent National Recommended Water Quality Criteria tables. Surface-water data were compared to U.S. EPA's National Recommended Water

⁴ These screening benchmarks were provided to United Park by Dan Wall of U.S. EPA Region 8. Attachment E1.

Quality Criteria⁵ for Aquatic Life to identify CoPCs for aquatic receptors.⁶ The chronic water quality criteria, the Criterion Continuous Concentration (i.e., the lowest criteria), was used in the CoPC screening. The Criterion Continuous Concentration (CCC) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. Toxicological data for fish and invertebrates, which the aquatic life criteria are based upon, are generally considered to also be protective of aquatic macrophytes (Rand 1995); therefore, the results of the surface-water screening are also considered relevant for assessing potential effects in aquatic/wetland plants.

Mobility and bioavailability of certain metals in surface water is influenced by water hardness. Therefore, Site-specific water hardness was taken into account for the determination of the surface-water screening levels for cadmium, copper, chromium, lead, nickel, silver, and zinc, as specified by the formulas provided in the National Recommended Water Quality Criteria. If the site-specific hardness is greater than or equal to 400 mg/L CaCO₃, a default value of 400 mg/L must be used in the hardness adjustment calculations. Because the average water hardness for the Site is greater than 400 mg/L (as CaCO₃), the default maximum value (400 mg/L) was used in the hardness adjustment calculations for these seven metals.

Freshwater criteria for metals are expressed in terms of the dissolved metal in the water column (see Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria⁷); therefore, the dissolved metals concentrations were used in the surface water data screening.

Per U.S. EPA Region 8 (Attachment E1), for chemicals with no National Recommended Water Quality Criteria, the lowest of the following values was used to screen the data for potential effects on aquatic receptors (i.e., fish and aquatic invertebrates).

⁵ <https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table>

⁶ The Surface Water Toxicity Benchmarks for Aquatic Receptors provided by U.S. EPA Region 8 (see Attachment E1) were updated based on more recent water quality criteria provided in the National Recommended Water Quality Aquatic Life Criteria Table at the link above.

⁷ <http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=60001CLZ.txt>

- The Great Lakes Water Quality Initiative (GLWQI) Tier II secondary chronic values (SCVs),
- The U.S. EPA Region 4 chronic screening values (U.S. EPA 2015b), or
- The Oak Ridge National Laboratory (ORNL) lowest chronic values (LCVs) (Suter and Tsao 1996).

Table E-1 presents the screening results for surface water samples compared with National Recommended Water Quality Criteria for Aquatic Life. Concentrations of cadmium, calcium, lead, manganese, and zinc exceeded criteria or benchmarks for aquatic life. Calcium is an essential nutrient, and therefore is not retained as a CoPC. Cadmium, lead, manganese, and zinc are CoPCs for surface water based on the potential for effects to aquatic life.

To screen the data for potential effects of contaminants in surface water on amphibians, U.S. EPA Region 8 identified screening-level toxicity benchmarks from the U.S. EPA Ecotoxicology (ECOTOX) database⁸ and the Database of Reptile and Amphibian Toxicology Literature (RATL) developed by Environment Canada (Pauli et al. 2000). Table E-2 presents the screening results for surface water samples compared with aqueous screening benchmarks for amphibians. Concentrations of aluminum, arsenic, cadmium, copper, lead, manganese, and zinc exceeded screening benchmarks for amphibians and are retained as CoPCs in surface water. Barium, iron, thallium, and vanadium do not have screening values for effects to amphibians. Aluminum and thallium were not detected, and vanadium has a very low frequency of detection (1%), therefore these chemicals are not retained as CoPCs. Barium and iron are retained as CoPCs because of lack of screening values for amphibians.

⁸ <http://cfpub.epa.gov/ecotox/>

3.2 Sediment Screening

To identify CoPCs for benthic macroinvertebrates exposure to sediment, Site sediment data were compared to the lowest of the following values provided by U.S. EPA Region 8 (Attachment E1):

- The threshold effect concentration (TEC) from the Consensus-Based Sediment Quality Guidelines (SQGs, MacDonald et al. 2000),
- The Assessment and Remediation of Contaminated Sediment (ARCS) Project Sediment Effect Concentrations, Threshold Effect Levels (TELs, Ingersoll et al. 1996), or
- The National Oceanic and Atmospheric Administration (NOAA) Sediment Effect Concentrations, Effect Range Low (ERL).

Table E-3 presents the screening results for sediment samples compared with sediment toxicity benchmarks for benthic macroinvertebrates. Site concentrations of aluminum, antimony, arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, silver, and zinc in sediment exceeded screening values and these chemicals are retained as CoPCs. There are no sediment benchmark values for barium, beryllium, cobalt, selenium, thallium, and vanadium. Of these chemicals, beryllium was not detected, therefore it is not a CoPC. Barium, cobalt, thallium, and vanadium are retained as CoPCs due to a lack of screening values, and selenium is bioaccumulative and is also retained as a CoPC.

3.3 Surface Soil Screening

Surface-soil data were screened against ecological risk-based soil screening levels to identify CoPCs for terrestrial receptors (i.e., wildlife, plants, and soil invertebrates) exposure to chemicals in soil.

To screen the data for potential effects to soil invertebrates and plants, the lowest of the following benchmarks were used, as provided by U.S. EPA Region 8 (Attachment E1):

- The U.S. EPA Ecological Soil Screening Levels (Eco-SSLs).⁹ Eco-SSLs are derived separately for four groups of ecological receptors, plants, soil invertebrates, birds and mammals. As such, these values are presumed to provide adequate protection of terrestrial ecosystems. The lower of the values for plants and soil invertebrates was used preferentially as the Eco-SSL.
- The ORNL lowest observed effect concentration (LOEC) for plants, soil organisms, and microbes (Efroymson et al. 1997a,b).

Table E-4 (sheets a through d) provides the data screening results for soil samples compared with benchmarks for effects to soil invertebrates and plants. Soil concentrations of aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, selenium, silver, thallium, vanadium, and zinc exceeded screening benchmarks in one or more samples; therefore, these inorganic constituents are identified as CoPCs for plants and soil invertebrates.

To identify CoPCs for wildlife exposure to soil, the soil data were screened against the lowest of the avian and mammalian Eco-SSLs. The Eco-SSL dataset was updated after U.S. EPA Region 8 provided United Park with their recommended screening values. The most recent interim Eco-SSL documents provided the source of the wildlife soil screening values. Table E-5 (sheets a through d) presents data screening results for soil samples compared with Eco-SSLs for effects to wildlife. Soil concentrations of antimony, arsenic, cadmium, chromium, copper, lead, manganese, selenium, silver, vanadium, and zinc exceeded the Eco-SSLs for birds or mammals. There are no Eco-SSLs for aluminum, iron, mercury, and thallium. Aluminum is identified as a CoPC only at sites where the soil pH is less than 5.5.¹⁰ The pH is not below 5.5 for soils sampled at OU2/3 (the soil pH averages 6.1 to 6.4 at the Site), therefore aluminum is not a CoPC. Iron is not considered a CoPC because it is considered micronutrient and is metabolized by plants and animals.¹¹ Mercury is bioaccumulative and can biomagnify in food chains; therefore, it is

⁹ <https://www.epa.gov/chemical-research/interim-ecological-soil-screening-level-documents>

¹⁰ https://www.epa.gov/sites/production/files/2015-09/documents/eco-ssl_aluminum.pdf

¹¹ https://www.epa.gov/sites/production/files/2015-09/documents/eco-ssl_iron.pdf

retained as CoPC. Thallium is also retained as CoPC because there is no screening value to evaluate the potential for effects of thallium on birds and mammals.

4 Summary of Results

The table below provides a summary of the chemicals that exceed the screening values, for each medium (and receptor group).

Media	Ecological CoPCs
Surface water	Cadmium, lead, manganese, zinc (aquatic life) Arsenic, barium, cadmium, copper, iron, lead, manganese, zinc (amphibians)
Sediment	Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, zinc (benthic macroinvertebrates)
Soil	Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, selenium, silver, thallium, vanadium, zinc (plants/soil invertebrates) Antimony, arsenic, cadmium, chromium, copper, lead, manganese, mercury, selenium, silver, thallium, vanadium, zinc (wildlife)

5 Conclusions

The objectives of the Phase 1 streamlined ecological risk evaluation are to 1) determine if data are adequate to address ecological risks, and 2) identify ecological CoPCs, based on a screening of available site data against default screening benchmarks. A scientific/management decision can be made based on the results of this Phase 1 streamlined ecological risk evaluation (the preliminary identification of ecological CoPCs), and that is:

The analysis indicates that measured concentrations of chemicals in site media exceed generic ecological risk-based screening values. Therefore, the media and associated exposure pathways cannot be eliminated as posing negligible risk based on this preliminary screening and a more thorough assessment may be warranted.

Note that U.S. EPA's (1997) guidance states that the scientific/management decision point made at the end of a screening-level risk calculation should not be used to set preliminary cleanup goals:

Screening ecotoxicity values are derived to avoid underestimating risk. Requiring a cleanup based solely on those values would not be technically defensible.

The next step in the streamlined ecological evaluation for OU2/3 could be to perform the exposure estimate and risk calculation, including the development of wildlife exposure models and development of toxicity reference values (TRVs) to assess effects, and the calculation of Hazard Quotients (HQs) to provide quantitative estimates of risk to ecological receptors. As part of this, the preliminary CoPCs could be refined based on site-specific information, and a more detailed characterization of ecological effects could be undertaken. The effects characterization could include reviewing and refining information on contaminant fate and transport; development of a background or reference dataset; and a literature search to identify no-observed-adverse-effect-levels (NOAELs) and low-observed-adverse-effect-levels (LOAELs), exposure-response functions, and the mechanisms of toxic responses that are more tailored to the Site.

A “lines of evidence” approach could be used for making conclusions regarding ecological risk at the Site, which could include species, community, and habitat considerations, comparisons to background or reference data, and an evaluation of the bioaccumulation and tissue residue data that are available for OU2/3.

The results from the any subsequent phase of the streamlined risk evaluation could allow for risk management decisions that include consideration of potential ecological risks from exposure to contaminants at OU2/3, if identified, and development of appropriate remedial options that respond to any ecological risks that may be identified for the Site.

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Appendix E Figures and Tables

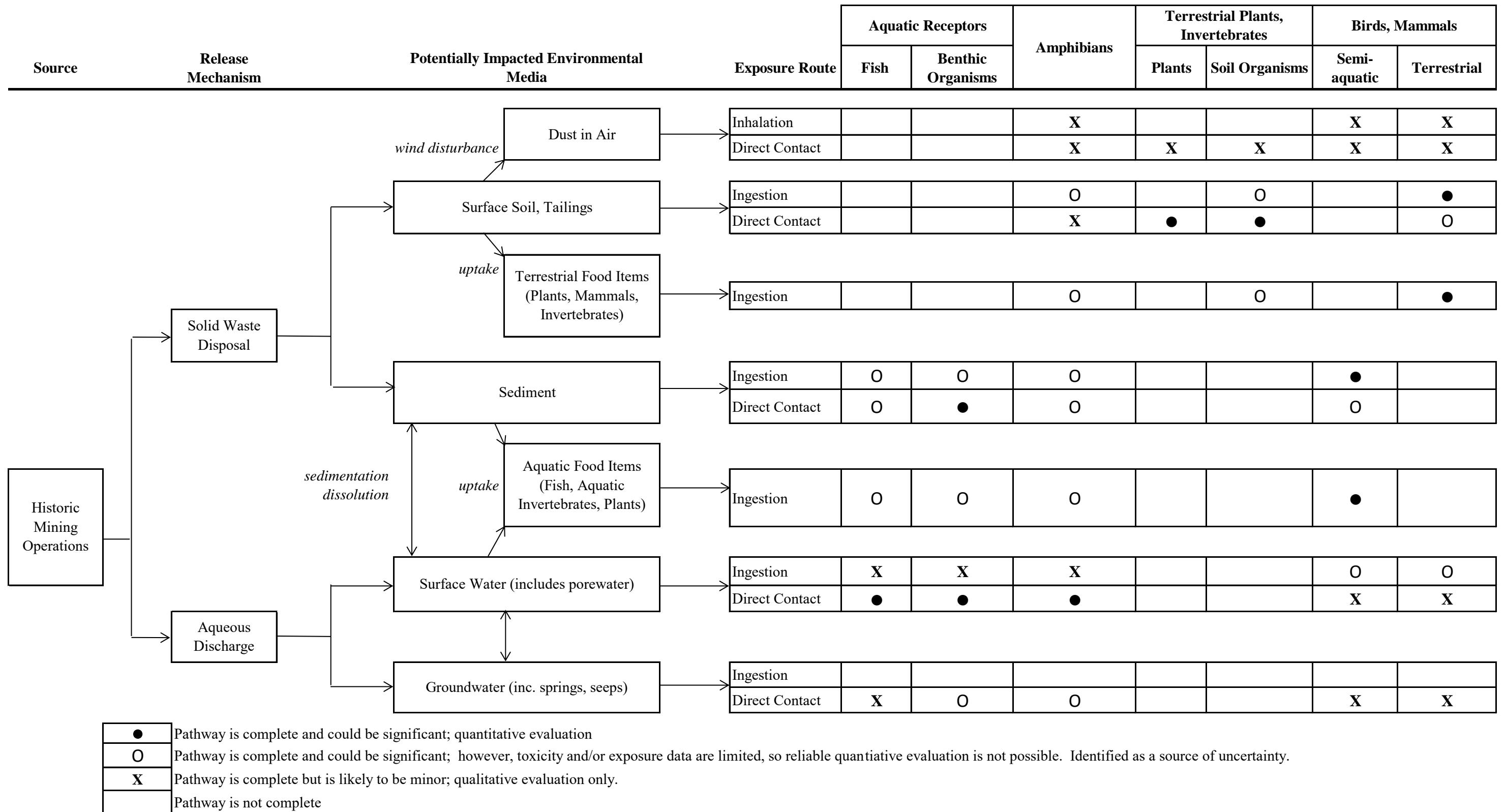


Figure E-1. Preliminary ecological conceptual site model

Table E-1. Screening results for surface water samples compared with National Recommended Water Quality Criteria for Aquatic Life

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Sample ID						
Surface Water Chronic Criteria (mg/L)	Operable Unit	Sample date	Habitat	N	count of NDs	% detected
Dissolved water						
0.087	wqc Aluminum	91	91	0%	0.016	0.016
0.03	scv Antimony	91	4	95.6%	0.000474	0.0209
0.15	wqc Arsenic	91	9	90.1%	0.000106	0.022
5.0	wqc Barium	91	0	100%	0.0195	0.397
0.00066	scv Beryllium	91	91	0%	0.0000119	0.0000119
0.00203	wqc Cadmium	91	46	49.5%	0.000171	0.00927
116	lcv Calcium	91	0	100%	46	411
0.231	wqc Chromium	91	90	1.1%	0.000436	0.00301
0.023	scv Cobalt	91	91	0%	0.0000416	0.0000416
0.029	wqc Copper	91	51	44.0%	0.000216	0.00882
1.0	wqc Iron	91	84	7.7%	0.046	0.234
0.011	wqc Lead	91	46	49.5%	0.000214	0.0265
82.0	lcv Magnesium	91	0	100%	11.1	88.1
0.12	scv Manganese	91	1	98.9%	0.0006	1.03
0.00077	wqc Mercury	91	91	0%	0.0000026	0.00000446
0.168	wqc Nickel	91	82	9.9%	0.00079	0.00384
53.0	lcv Potassium	91	0	100%	1.4	18.2
0.0050	wqc Selenium	91	91	0%	0.000135	0.000135
0.0035	wqc Silver	91	91	0%	0.0000217	0.0000217
680	lcv Sodium	91	0	100%	18.5	356
0.012	scv Thallium	91	91	0%	0.0000217	0.0000217
0.020	scv Vanadium	91	90	1.1%	0.00053	0.00572
0.382	wqc Zinc	91	2	97.8%	0.0045	3.15
no benchmark	Hardness, as CaCO ₃	91	0	100%	161	1330
no benchmark	Phosphate, Total (as P)	91	56	38.5%	0.0106	1.66
no benchmark	Total Suspended Solids	91	44	51.6%	1.415	119
no benchmark	Nitrate, as N	91	32	64.8%	0.00345	23.9
no benchmark	Chloride	91	0	100%	32.3	939
no benchmark	Sulfate	91	0	100%	12.6	723
no benchmark	Alkalinity, as CaCO ₃	91	0	100%	105	267
no benchmark	Total Dissolved Solids	91	0	100%	256	2190
						818

Table E-1. (cont.)

DRAFT

OU2 Samples														
	Sample ID	OU2-0-SW-AIRF	OU2-0-SW-AIRF	OU2-0-SW-AIRF	OU2-0-SW-ASCWWT	OU2-0-SW-ASCWWT	OU2-0-SW-ASCWWT	OU2-0-SW-ASCWWT	OU2-0-SW-ASCWWT	OU2-0-SW-BIRF				
Surface Water Chronic Criteria (mg/L)	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2				
Chronic Criteria (mg/L)	Sample date	3/9/2015	5/26/2015	8/31/2015	3/10/2015	5/26/2015	8/31/2015	10/8/2015	3/9/2015					
Dissolved water														
0.087	wqc Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016
0.03	scv Antimony	0.008		0.006		0.008		0.009		0.006		0.019		0.021
0.15	wqc Arsenic	0.006		0.006		0.009		0.004		0.005		0.022		0.013
5.0	wqc Barium	0.053		0.049		0.047		0.048		0.043		0.053		0.055
0.00066	scv Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012
0.00203	wqc Cadmium	0.004		0.002		0.00017	ND	0.005		0.003		0.00017	ND	0.003
116	lcv Calcium	146		145		106	ND	159		144		128		184
0.231	wqc Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436
0.023	scv Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042
0.029	wqc Copper	0.0077		0.0039		0.0087		0.0024		0.0032		0.0054		0.0042
1.0	wqc Iron	0.150		0.046		0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046
0.011	wqc Lead	0.027		0.004		0.009		0.003		0.003		0.008		0.003
82.0	lcv Magnesium	35.1		34.9		27.9		36.1		35.0		34.5		47.2
0.12	scv Manganese	0.209		0.159		0.052		0.249		0.157		0.305		0.360
0.00077	wqc Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045
0.168	wqc Nickel	0.0079	ND	0.0079	ND	0.0200		0.0079	ND	0.0079	ND	0.0079	ND	0.0079
53.0	lcv Potassium	7.26		4.49		16.60		3.23		1.87		4.61		5.18
0.0050	wqc Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135
0.0035	wqc Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022
680	lcv Sodium	185.0		135.0		203.0		159.0		102.0		81.8		98.2
0.012	scv Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022
0.020	scv Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001
0.382	wqc Zinc	1.510		0.880		0.140		1.790		0.827		0.282		0.658
no benchmark	Hardness, as CaCO ₃	508		523		396		545		518		482		668
no benchmark	Phosphate, Total (as P)	0.576		0.269		1.2		0.0106	ND	0.0106	ND	0.0106	ND	0.637
no benchmark	Total Suspended Solids	4.8		1.415	ND	1.415		4		1.415		1.415		6.4
no benchmark	Nitrate, as N	7.74		4.25		19.1		0.00345	ND	0.00345	ND	0.0163		8.44
no benchmark	Chloride	367		267		393		344		221		197		370
no benchmark	Sulfate	194		215		123		209		222		176		320
no benchmark	Alkalinity, as CaCO ₃	161		170		150		170		182		184		204
no benchmark	Total Dissolved Solids	1260		1020		1040		1070		860		768		1180

Table E-1. (cont.)

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OU2 Samples													
	Sample ID	OU2-0-SW-BIRF	OU2-0-SW-BIRF	OU2-0-SW-BIRF	OU2-0-SW-IRF	OU2-0-SW-IRF	OU2-0-SW-PPTRIB	OU2-0-SW-SC1	OU2-0-SW-SCBNPWR				
Surface Water Chronic Criteria (mg/L)	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
	Sample date	5/26/2015	8/31/2015	10/8/2015	3/9/2015	5/26/2015	3/9/2015	10/8/2015	3/11/2015				
Habitat		Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream				
	Dissolved water												
0.087	wqc Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND
0.03	scv Antimony	0.006		0.012		0.017		0.004		0.006		0.000	0.005
0.15	wqc Arsenic	0.006		0.013		0.016		0.002		0.006		0.000	0.016
5.0	wqc Barium	0.048		0.047		0.053		0.030		0.049		0.158	0.145
0.00066	scv Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND
0.00203	wqc Cadmium	0.002		0.0002	ND	0.0006		0.0002	ND	0.0022		0.0002	ND
116	lcv Calcium	146		107	143		264		144		69		74
0.231	wqc Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND
0.023	scv Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND
0.029	wqc Copper	0.0038		0.0082		0.0063		0.0002		0.0039		0.0002	ND
1.0	wqc Iron	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.114	0.046
0.011	wqc Lead	0.003		0.009		0.005		0.000		0.003		0.000	ND
82.0	lcv Magnesium	35.2		28.0		34.7		64.9		33.9		15.2	18.7
0.12	scv Manganese	0.185		0.066		0.251		0.538		0.163		0.100	0.201
0.00077	wqc Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND
0.168	wqc Nickel	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND
53.0	lcv Potassium	3.92		16.00		10.50		12.70		4.40		10.30	4.70
0.0050	wqc Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND
0.0035	wqc Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
680	lcv Sodium	126.0		196.0		143.0		75.2		131.0		32.4	32.6
0.012	scv Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
0.020	scv Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
0.382	wqc Zinc	0.972		0.168		0.461		0.064		0.895		0.005	ND
no benchmark	Hardness, as CaCO ₃	540		409		501		935		531		230	262
no benchmark	Phosphate, Total (as P)	0.256		1.17		0.771		0.265		0.3		0.253	0.0548
no benchmark	Total Suspended Solids	4		1.415	ND	3.2		7.6		3.2		1.415	ND
no benchmark	Nitrate, as N	3.58		17.9		10.9		1.31		3.89		0.943	0.318
no benchmark	Chloride	289		381		263		309		259		90.4	89.5
no benchmark	Sulfate	216		128		221		460		206		12.6	32.1
no benchmark	Alkalinity, as CaCO ₃	175		150		164		159		173		167	177
no benchmark	Total Dissolved Solids	1140		964		1030		1480		948		408	388

Table E-1. (cont.)

DRAFT

OU2 Samples													
Chronic Criteria (mg/L)	Sample ID	OU2-0-SW-SCBNPRR		OU2-0-SW-SCBNPRR		OU2-0-SW-SCBNPRR		OU2-0-SW-SCI		OU2-0-SW-SCI		OU2-0-SW-SCI80	
						Dups avg							
		Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2	Dups avg	Dups avg
Surface Water	Sample date	5/27/2015	Stream	9/1/2015	Stream	10/8/2015	Stream	3/9/2015	Stream	5/26/2015	Stream	8/31/2015	Stream
Dissolved water													
0.087	wqc Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND
0.03	scv Antimony	0.005		0.007		0.018		0.005		0.005		0.010	0.007
0.15	wqc Arsenic	0.005		0.010		0.009		0.014		0.012		0.013	0.008
5.0	wqc Barium	0.042		0.046		0.042		0.120		0.130		0.139	0.056
0.00066	scv Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND
0.00203	wqc Cadmium	0.002		0.0002	ND	0.0008		0.0002	ND	0.0002	ND	0.0036	0.0028
116	lcv Calcium	159		127		180		64		70		141	146
0.231	wqc Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND
0.023	scv Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND
0.029	wqc Copper	0.0022		0.0024		0.0033		0.0002	ND	0.0002	ND	0.0027	0.0042
1.0	wqc Iron	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046	ND
0.011	wqc Lead	0.000	ND	0.003		0.007		0.003		0.004		0.005	0.010
82.0	lcv Magnesium	37.0		32.1		46.3		16.1		16.3		15.0	34.6
0.12	scv Manganese	0.112		0.105		0.114		0.111		0.069		0.264	0.214
0.00077	wqc Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND
0.168	wqc Nickel	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND
53.0	lcv Potassium	1.74		3.87		5.00		3.84		2.79		2.13	3.59
0.0050	wqc Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND
0.0035	wqc Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
680	lcv Sodium	108.0		73.7		94.7		21.7		25.8		24.2	115.0
0.012	scv Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
0.020	scv Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
0.382	wqc Zinc	0.689		0.185		0.672		0.048		0.041		1.710	1.095
no benchmark	Hardness, as CaCO ₃	509		477		649		219		240		221	486
no benchmark	Phosphate, Total (as P)	0.0106	ND	0.035		0.0106	ND	0.122		0.0579		0.0106	0.347
no benchmark	Total Suspended Solids	1.415	ND	1.42		1.415	ND	6		1.415		1.415	2.71
no benchmark	Nitrate, as N	0.00345	ND	0.0192		0.00345	ND	0.582		0.52		0.0129	4.71
no benchmark	Chloride	210		169		191		65.5		71.5		63.7	240
no benchmark	Sulfate	212		175		313		25.6		26.5		19.1	208
no benchmark	Alkalinity, as CaCO ₃	189		194		199		159		163		161	182
no benchmark	Total Dissolved Solids	884		672		968		332		408		312	942

Table E-1. (cont.)

DRAFT

OU2 Samples														
Surface Water Chronic Criteria (mg/L)	Operable Unit	Sample ID	OU2-0-SW-SCI80	OU2-0-SW-SCI80	OU2-0-SW-SCWWT	OU2-0-SW-SCWWT	OU2-0-SW-SCWWT	OU2-0-SW-SCWWT	OU2-0-SW-SGDINF	OU2-0-SW-SPRRP	OU2-0-SW-STRGD			
		Dups avg	Dups avg	Dups avg	OU2	OU2	OU2	OU2	OU2	OU2	OU2			
	Sample date	8/31/2015	10/8/2015	3/10/2015	5/26/2015	8/31/2015	10/8/2015	3/10/2015	3/10/2015	3/10/2015	3/10/2015			
Dissolved water														
0.087	wqc Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016
0.03	scv Antimony	0.018	0.020	0.000	ND	0.002	0.002	0.003	0.012	0.009	0.009	0.003		
0.15	wqc Arsenic	0.020	0.022	0.003	0.003	0.004	0.004	0.009	0.011	0.011	0.011	0.003		
5.0	wqc Barium	0.077	0.077	0.060	0.065	0.049	0.051	0.031	0.044	0.044	0.044	0.076		
0.00066	scv Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012
0.00203	wqc Cadmium	0.0002	ND	0.0007	0.0006	0.0009	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND
116	lcv Calcium	96	132	116	138	106	99	411	46	219				
0.231	wqc Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436
0.023	scv Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042
0.029	wqc Copper	0.0057	0.0055	0.0077	0.0057	0.0083	0.0088	0.0041	0.0002	0.0002	0.0002	0.0002	ND	ND
1.0	wqc Iron	0.046	ND	0.119	0.046	0.046	ND	0.046	ND	0.046	ND	0.125	0.046	ND
0.011	wqc Lead	0.006	0.016	0.006	0.002	0.005	0.004	0.000	0.004	0.004	0.000	0.000	ND	ND
82.0	lcv Magnesium	24.8	31.9	28.8	34.5	27.6	23.6	88.1	12.3	54.2				
0.12	scv Manganese	0.108	0.298	0.048	0.035	0.013	0.011	0.335	0.053	0.171				
0.00077	wqc Mercury	0.000045	ND	0.000045	ND	0.000045	ND	0.000045	ND	0.000045	ND	0.000045	ND	0.000045
0.168	wqc Nickel	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.0079
53.0	lcv Potassium	12.70	9.41	14.80	13.30	18.20	16.70	2.37	3.66	2.86				
0.0050	wqc Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135
0.0035	wqc Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022
680	lcv Sodium	149.5	120.5	213.5	240.0	224.0	210.0	107.0	19.5	172.0				
0.012	scv Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022
0.020	scv Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001
0.382	wqc Zinc	0.296	0.513	0.260	0.299	0.069	0.099	3.150	0.485	0.668				
no benchmark	Hardness, as CaCO ₃	358	463	405	493	395	355	1330	162	738				
no benchmark	Phosphate, Total (as P)	0.864	0.54	1.62	1.3	1.45	1.66	0.0106	ND	0.0548	0.0106	ND		
no benchmark	Total Suspended Solids	1.42	ND	2.31	12.0	6	4.8	4.4	1.415	ND	1.415	ND	1.415	ND
no benchmark	Nitrate, as N	13.6	6.8	20.6	17.2	22.9	23.9	0.00345	ND	0.00345	ND	0.00345	ND	0.00345
no benchmark	Chloride	300	222	392	448	427	329	387	32.3	532				
no benchmark	Sulfate	98	188	141	187	117	111	723	31.8	111				
no benchmark	Alkalinity, as CaCO ₃	161	180	133	136	145	139	267	127	249				
no benchmark	Total Dissolved Solids	862	860	1065	1270	1100	1060	1730	352	1390				

Table E-1. (cont.)

DRAFT

OU3 Samples													
	Sample ID	OU3-0-SW-ASCAOU4	OU3-0-SW-HS	OU3-0-SW-MRUBP	OU3-0-SW-MRUBP	OU3-0-SW-MRUBP	OU3-0-SW-MRUBP	OU3-0-SW-NGCF	OU3-0-SW-NPCWR				
Surface Water Chronic Criteria (mg/L)	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3				
	Sample date	3/16/2015	3/11/2015	11/12/2014	3/13/2015	5/28/2015	9/2/2015	3/11/2015	3/10/2015				
	Habitat	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream				
	Dissolved water												
0.087	wqc Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND
0.03	scv Antimony	0.005		0.000	ND	0.005		0.005		0.006		0.004	
0.15	wqc Arsenic	0.003		0.000	ND	0.000		0.003		0.003		0.000	
5.0	wqc Barium	0.034		0.132		0.022		0.032		0.037		0.29	
0.00066	scv Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND
0.00203	wqc Cadmium	0.0022		0.0002	ND	0.0005		0.0015		0.0007		0.0002	ND
116	lcv Calcium	67		48		94		87		94		88	269
0.231	wqc Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND
0.023	scv Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND
0.029	wqc Copper	0.0031		0.0002	ND	0.0002		0.0002	ND	0.0002		0.0002	
1.0	wqc Iron	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046	ND
0.011	wqc Lead	0.002		0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND
82.0	lcv Magnesium	13.5		11.4		14.2		15.4		15.3		13.9	80.1
0.12	scv Manganese	0.046		0.001	ND	0.088		0.069		0.100		0.017	0.244
0.00077	wqc Mercury	0.0000045	ND	0.0000045	ND	0.0000026	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND
0.168	wqc Nickel	0.0079	ND	0.0079	ND	0.00212		0.0079	ND	0.0079	ND	0.0079	ND
53.0	lcv Potassium	1.89		3.51		2.15		2.48		2.21		1.88	11.00
0.0050	wqc Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND
0.0035	wqc Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
680	lcv Sodium	104.0		18.5		60.4		110.0		112.0		58.9	356.0
0.012	scv Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
0.020	scv Vanadium	0.001	ND	0.006		0.001	ND	0.001	ND	0.001	ND	0.001	ND
0.382	wqc Zinc	0.544		0.005	ND	0.610		0.542		0.305		0.117	1.670
no benchmark	Hardness, as CaCO ₃	232		161		296		277		306		299	934
no benchmark	Phosphate, Total (as P)	0.0106	ND	0.125		0.0106	ND	0.0106	ND	0.0713		0.0106	ND
no benchmark	Total Suspended Solids	6.4		9.2		3.6		3.6		3.6		7.2	4.4
no benchmark	Nitrate, as N	0.0109		0.76		0.253		0.0804		0.115		0.016	0.00345
no benchmark	Chloride	189		44.1		112		180		198		117	939
no benchmark	Sulfate	93.1		14.2		166		135		137		113	58.3
no benchmark	Alkalinity, as CaCO ₃	107		116		114		120		108		130	234
no benchmark	Total Dissolved Solids	468		256		400		576		628		448	2140
													1080

Table E-1. (cont.)

DRAFT

OU3 Samples														
Chronic Criteria (mg/L)	Sample ID	OU3-0-SW-NPCWR		OU3-0-SW-NPCWR		OU3-0-SW-NPCWR		OU3-0-SW-SC1C		OU3-0-SW-SC1C		OU3-0-SW-SC1C		
		Dups avg		OU3		OU3		OU3		OU3		OU3		
		Operable Unit	OU3	Sample date	8/31/2015	Habitat	Stream	OU3	3/11/2015	OU3	5/27/2015	9/1/2015	10/8/2015	3/13/2015
Dissolved water														
0.087	wqc Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016
0.03	scv Antimony	0.006		0.017		0.020		0.007		0.006		0.008		0.007
0.15	wqc Arsenic	0.005		0.017		0.010		0.003		0.007		0.009		0.007
5.0	wqc Barium	0.045		0.053		0.051		0.044		0.034		0.054		0.044
0.00066	scv Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012
0.00203	wqc Cadmium	0.0037		0.0002	ND	0.0005		0.0020		0.0016		0.0002	ND	0.0002
116	lcv Calcium	156		130		180		136		131		118		131
0.231	wqc Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436
0.023	scv Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042
0.029	wqc Copper	0.0029		0.0041		0.0035		0.0002		0.0024		0.0002	ND	0.0002
1.0	wqc Iron	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.234		0.046	ND	0.046
0.011	wqc Lead	0.000	ND	0.004		0.005		0.000	ND	0.021		0.003	ND	0.004
82.0	lcv Magnesium	36.8		34.7		46.2		32.5		31.6		29.5		29.7
0.12	scv Manganese	0.197		0.288		0.292		0.062		0.152		0.459		0.193
0.00077	wqc Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045
0.168	wqc Nickel	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.0079
53.0	lcv Potassium	1.74		4.58		5.13		2.70		1.58		2.70		2.20
0.0050	wqc Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135
0.0035	wqc Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022
680	lcv Sodium	107.0		81.3		94.8		155.0		86.4		68.6		51.3
0.012	scv Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022
0.020	scv Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001
0.382	wqc Zinc	1.455		0.202		0.638		0.549		0.287		0.054	0.105	0.425
no benchmark	Hardness, as CaCO ₃	519		488		642		459		420		449		435
no benchmark	Phosphate, Total (as P)	0.011	ND	0.0106	ND	0.0106	ND	0.0106	ND	0.0106	ND	0.0106	ND	0.0106
no benchmark	Total Suspended Solids	1.4	ND	1.415	ND	1.415	ND	1.415	ND	5.2		5.6		4.8
no benchmark	Nitrate, as N	0.0035	ND	0.0312		0.00345	ND	0.00345	ND	0.00345	ND	0.0218		0.0815
no benchmark	Chloride	219		199		212		285		157		156		235
no benchmark	Sulfate	223		184		321		206		212		156		176
no benchmark	Alkalinity, as CaCO ₃	186		189		203		138		133		184		162
no benchmark	Total Dissolved Solids	902		712		1000		816		648		608		792

Table E-1. (cont.)

DRAFT

OU3 Samples													
Chronic Criteria (mg/L)	Sample ID	OU3-0-SW-SC248AC	OU3-0-SW-SC248AC	OU3-0-SW-SC248AC	OU3-0-SW-SC248BC	OU3-0-SW-SC248BC	OU3-0-SW-SC248BC	OU3-0-SW-SC248BC	OU3-0-SW-SC248BC	OU3-0-SW-SC248BC	OU3-9-SW-SC248BC		
		Surface Water	Operable Unit	OU3	OU3	OU3	Dups avg	Dups avg	OU3	OU3	OU3	OU3	
		Chronic Criteria (mg/L)	Sample date	5/25/2015	9/1/2015	10/9/2015	3/13/2015	5/28/2015	9/1/2015	10/9/2015	10/9/2015		
Dissolved water													
0.087	wqc Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND
0.03	scv Antimony	0.004		0.006		0.006		0.005		0.005		0.006	
0.15	wqc Arsenic	0.005		0.010		0.009		0.004		0.005		0.010	
5.0	wqc Barium	0.057		0.167		0.121		0.039		0.033		0.052	
0.00066	scv Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND
0.00203	wqc Cadmium	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND
116	lcv Calcium	132		192		205		159		119		118	
0.231	wqc Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND
0.023	scv Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND
0.029	wqc Copper	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND
1.0	wqc Iron	0.046	ND	0.046	ND	0.154		0.046	ND	0.046	ND	0.046	ND
0.011	wqc Lead	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.002	ND	0.004	ND
82.0	lcv Magnesium	31.6		46.4		48.1		37.3		29.8		28.5	
0.12	scv Manganese	0.598		1.030		0.968		0.489		0.200		0.481	
0.00077	wqc Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND
0.168	wqc Nickel	0.00079	ND	0.00079	ND	0.00079	ND	0.00079	ND	0.00079	ND	0.00079	ND
53.0	lcv Potassium	1.68		2.71		2.03		2.57		1.66		2.56	
0.0050	wqc Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND
0.0035	wqc Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
680	lcv Sodium	94.8		215.0		172.0		112.0		70.2		68.6	
0.012	scv Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
0.020	scv Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
0.382	wqc Zinc	0.309		0.852		0.672		0.365		0.235		0.087	
no benchmark	Hardness, as CaCO ₃	435		700		644		557		397		444	
no benchmark	Phosphate, Total (as P)	0.0106	ND	0.0106	ND	0.0106	ND	0.035		0.011	ND	0.0718	
no benchmark	Total Suspended Solids	16.4		1.415		1.415		ND		2.7		3.4	
no benchmark	Nitrate, as N	0.0587		0.0619		0.00345		ND		0.060		0.013	
no benchmark	Chloride	210		608		397		224		144		140	
no benchmark	Sulfate	198		146		233		267		214		145	
no benchmark	Alkalinity, as CaCO ₃	156		208		210		161		135		181	
no benchmark	Total Dissolved Solids	768		1550		1230		914		642		600	
													636
													700

Table E-1. (cont.)

DRAFT

OU3 Samples													
	Sample ID	OU3-0-SW-SC248NRB	OU3-0-SW-SC248NRB	OU3-0-SW-SC248NRB	OU3-0-SW-SCAOU4	OU3-0-SW-SCAOU4	OU3-0-SW-SCAOU4	OU3-0-SW-SCBOU4	OU3-0-SW-SCBOU4	OU3-0-SW-SCBOU4	OU3-0-SW-SCBOU4	OU3-0-SW-SCBOU4	OU3-0-SW-SCBOU4
Surface Water Chronic Criteria (mg/L)	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	3/11/2015	5/27/2015	10/8/2015	11/12/2014	5/28/2015	9/2/2015	11/12/2014	3/16/2015				
	Habitat	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream				
	Dissolved water												
0.087	wqc Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND
0.03	scv Antimony	0.006		0.004		0.010		0.006		0.006		0.005	
0.15	wqc Arsenic	0.003		0.004		0.008		0.003		0.004		0.003	
5.0	wqc Barium	0.044		0.049		0.036		0.020		0.036		0.025	
0.00066	scv Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND
0.00203	wqc Cadmium	0.0020		0.0014		0.0027		0.0008		0.0002		0.0006	
116	lcv Calcium	141		148		134		64		78		68	
0.231	wqc Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND
0.023	scv Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND
0.029	wqc Copper	0.0002	ND	0.0002	ND	0.0040		0.0002	ND	0.0023		0.0002	ND
1.0	wqc Iron	0.046	ND	0.046	ND	0.046		0.046	ND	0.046		0.046	ND
0.011	wqc Lead	0.000	ND	0.002		0.003		0.000	ND	0.000		0.000	ND
82.0	lcv Magnesium	32.7		35.2		30.9		11.1		13.5		11.4	
0.12	scv Manganese	0.053		0.133		0.029		0.018		0.052		0.047	
0.00077	wqc Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000026	ND	0.0000045	ND	0.0000026	ND
0.168	wqc Nickel	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.00208	
53.0	lcv Potassium	2.78		2.14		2.82		1.47		1.74		1.40	
0.0050	wqc Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND
0.0035	wqc Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
680	lcv Sodium	164.0		118.0		61.5		28.3		98.6		30.7	
0.012	scv Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	61.6	
0.020	scv Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.00022	ND
0.382	wqc Zinc	0.697		0.654		1.110		0.338		0.108		0.200	0.623
no benchmark	Hardness, as CaCO ₃	474		489		466		208		254		230	
no benchmark	Phosphate, Total (as P)	0.0106	ND	0.0106	ND	0.0106	ND	0.0106	ND	0.0106	ND	0.251	
no benchmark	Total Suspended Solids	1.415	ND	1.415	ND	1.415	ND	6		12.4		11.6	
no benchmark	Nitrate, as N	0.00345	ND	0.00345	ND	0.00345	ND	0.152		0.0701		0.0332	
no benchmark	Chloride	300		223		108		50.4		182		62.5	
no benchmark	Sulfate	224		185		259		89		101		83.7	
no benchmark	Alkalinity, as CaCO ₃	158		189		159		108		105		118	
no benchmark	Total Dissolved Solids	832		848		608		280		452		292	
												492	664

Table E-1. (cont.)

DRAFT

OU3 Samples														
	Sample ID	OU3-9-SW-SCBOU4	OU3-0-SW-SCBOU4	OU3-0-SW-SCHFTR	OU3-0-SW-SCHFTR	OU3-0-SW-SCHFTR	OU3-0-SW-SCHFTR	OU3-0-SW-SCOU3BC	OU3-0-SW-SCOU3BC	OU3-9-SW-SCOU3BC				
Surface Water Chronic Criteria (mg/L)	Operable Unit	OU3	OU3	OU3										
	Sample date	3/16/2015	5/28/2015	3/13/2015	5/28/2015	9/1/2015	10/9/2015	3/11/2015	3/11/2015					
Habitat		Stream	Stream											
	Dissolved water													
0.087	wqc Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016
0.03	scv Antimony	0.004		0.006		0.007		0.005		0.007		0.006		0.006
0.15	wqc Arsenic	0.000	ND	0.003		0.004		0.006		0.008		0.006		0.000
5.0	wqc Barium	0.035		0.037		0.040		0.031		0.051		0.044		0.059
0.00066	scv Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012
0.00203	wqc Cadmium	0.0015		0.0008		0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0067
116	lcv Calcium	98		92		108		116		107		124		201
0.231	wqc Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.003010
0.023	scv Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042
0.029	wqc Copper	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0029		0.0030
1.0	wqc Iron	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046
0.011	wqc Lead	0.000	ND	0.000	ND	0.000	ND	0.002	ND	0.000	ND	0.000	ND	0.000
82.0	lcv Magnesium	16.6		15.3		25.5		28.0		24.0		26.5		52.2
0.12	scv Manganese	0.116		0.092		0.287		0.146		0.423		0.410		0.212
0.00077	wqc Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045
0.168	wqc Nickel	0.00216		0.00079	ND	0.00079	ND	0.00079	ND	0.00079	ND	0.00273		0.00366
53.0	lcv Potassium	2.72		2.14		2.49		1.72		2.56		2.26		4.23
0.0050	wqc Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135
0.0035	wqc Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022
680	lcv Sodium	152.0		109.0		117.0		69.5		67.5		58.0		213.0
0.012	scv Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022
0.020	scv Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001
0.382	wqc Zinc	0.944		0.333		0.323		0.162		0.157		0.214		1.930
no benchmark	Hardness, as CaCO ₃	305		298		381		416		388		395		731
no benchmark	Phosphate, Total (as P)	0.0106	ND	0.0106	ND	0.0106	ND	0.0106	ND	0.0106	ND	0.0106	ND	
no benchmark	Total Suspended Solids	4.4		5.6		5.6		4		1.415		1.415		1.415
no benchmark	Nitrate, as N	0.101		0.15		0.082		0.0333		0.0272		0.00345		0.00345
no benchmark	Chloride	243		187		208		136		133		97.7		501
no benchmark	Sulfate	160		127		166		204		134		216		227
no benchmark	Alkalinity, as CaCO ₃	115		112		132		138		169		154		202
no benchmark	Total Dissolved Solids	700		580		720		620		536		676		1360

Table E-1. (cont.)

DRAFT

OU3 Samples													
	Sample ID	OU3-0-SW-SCOU3BC	OU3-0-SW-SCRF72	OU3-0-SW-SCRF72	OU3-0-SW-SCRF72	OU3-0-SW-SCRF72	OU3-0-SW-SCRFR	OU3-0-SW-SCRFR	OU3-0-SW-SCRFR				
Surface Water Chronic Criteria (mg/L)	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3				
	Sample date	5/27/2015	3/13/2015	5/28/2015	9/1/2015	10/9/2015	11/12/2014	3/13/2015	5/28/2015				
	Habitat	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream				
Dissolved water													
0.087	wqc Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND
0.03	scv Antimony	0.003		0.007		0.005		0.006		0.007		0.005	
0.15	wqc Arsenic	0.000	ND	0.004		0.006		0.007		0.006		0.004	
5.0	wqc Barium	0.110		0.040		0.031		0.048		0.043		0.036	
0.00066	scv Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND
0.00203	wqc Cadmium	0.0052		0.0007		0.0002		0.0002		0.0002		0.0002	
116	lcv Calcium	302		108		115		106		116		113	
0.231	wqc Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND
0.023	scv Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND
0.029	wqc Copper	0.0033		0.0002		0.0002		0.0002		0.0002		0.0002	
1.0	wqc Iron	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.146		0.046	
0.011	wqc Lead	0.000	ND	0.005	ND	0.000	ND	0.000	ND	0.015		0.000	
82.0	lcv Magnesium	80.7		25.0		28.0		23.6		25.8		23.1	
0.12	scv Manganese	0.281		0.266		0.148		0.286		0.336		0.256	
0.00077	wqc Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000026	ND	0.0000045	ND
0.168	wqc Nickel	0.00384		0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND
53.0	lcv Potassium	6.43		2.42		1.75		2.47		2.39		2.56	
0.0050	wqc Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND
0.0035	wqc Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
680	lcv Sodium	304.0		116.0		68.5		67.5		55.5		67.5	
0.012	scv Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
0.020	scv Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
0.382	wqc Zinc	1.150		0.386		0.228		0.143		0.223		0.174	
no benchmark	Hardness, as CaCO ₃	1010		385		425		391		381		410	
no benchmark	Phosphate, Total (as P)	0.0106	ND	1.01	0.0106	ND	0.054	0.0106	ND	0.0614	0.0106	ND	0.0106
no benchmark	Total Suspended Solids	1.415	ND	4.8		4.8		1.415	ND	5.6		5.6	
no benchmark	Nitrate, as N	0.00345	ND	0.0747		0.027		0.0314	0.00345	ND	0.018	0.0593	0.00345
no benchmark	Chloride	826		211		137		127		98.9		133	
no benchmark	Sulfate	155		164		204		129		215		193	
no benchmark	Alkalinity, as CaCO ₃	264		136		133		181		152		144	
no benchmark	Total Dissolved Solids	2190		680		608		592		664		640	
												708	672

Table E-1. (cont.)

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OU3 Samples													
Chronic Criteria (mg/L)	Sample ID	OU3-0-SW-SCRFR		OU3-0-SW-SCURTFB		OU3-0-SW-SCURTFB		OU3-0-SW-SCURTFB		OU3-9-SW-SCURTFB		OU3-0-SW-SPCW	
		Operable Unit		OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
		Sample date	9/1/2015	11/12/2014	3/13/2015	5/28/2015	9/2/2015	9/2/2015	3/10/2015	3/10/2015	5/27/2015	5/27/2015	
Dissolved water													
0.087	wqc Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND
0.03	scv Antimony	0.007		0.005		0.007		0.005		0.005		0.008	
0.15	wqc Arsenic	0.007		0.005		0.006		0.007		0.008		0.004	
5.0	wqc Barium	0.050		0.034		0.034		0.031		0.039		0.041	
0.00066	scv Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND
0.00203	wqc Cadmium	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0039	0.0020
116	lcv Calcium	101		110		99		107		92		93	
0.231	wqc Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND
0.023	scv Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND
0.029	wqc Copper	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0024	0.0030
1.0	wqc Iron	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046	ND
0.011	wqc Lead	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.002	0.000
82.0	lcv Magnesium	22.0		20.7		20.4		22.7		17.9		17.2	
0.12	scv Manganese	0.442		0.128		0.102		0.097		0.127		0.129	
0.00077	wqc Mercury	0.0000045	ND	0.0000026	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND
0.168	wqc Nickel	0.00079	ND	0.00079	ND	0.00079	ND	0.00079	ND	0.00079	ND	0.00079	ND
53.0	lcv Potassium	2.76		2.21		2.38		1.98		2.35		2.34	
0.0050	wqc Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND
0.0035	wqc Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
680	lcv Sodium	72.1		62.0		117.0		97.0		59.6		59.9	
0.012	scv Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
0.020	scv Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
0.382	wqc Zinc	0.115		0.205		0.231		0.122		0.091		0.096	
no benchmark	Hardness, as CaCO ₃	353		374		327		330		325		528	502
no benchmark	Phosphate, Total (as P)	0.0978		0.054		0.0106	ND	0.0106		0.0106	ND	0.0106	ND
no benchmark	Total Suspended Solids	8		12.0		1.415	ND	1.415	ND	4		1.415	1.415
no benchmark	Nitrate, as N	0.00345	ND	0.22		0.105		0.0122		0.0271		0.0281	0.00345
no benchmark	Chloride	137		126		190		178		123		122	346
no benchmark	Sulfate	140		184		153		169		130		132	215
no benchmark	Alkalinity, as CaCO ₃	159		130		124		131		135		135	175
no benchmark	Total Dissolved Solids	616		484		644		644		472		532	1040
													812

Table E-1. (cont.)

DRAFT

OU3 Samples					
	Sample ID	OU3-0-SW-SPCWR	OU3-0-SW-SPCWR		
Surface Water Chronic Criteria (mg/L)	Operable Unit	OU3	OU3		
	Sample date	8/31/2015	10/8/2015		
	Habitat	Stream	Stream		
Dissolved water					
0.087	wqc Aluminum	0.016	ND	0.016	ND
0.03	scv Antimony	0.011		0.018	
0.15	wqc Arsenic	0.015		0.008	
5.0	wqc Barium	0.049		0.044	
0.00066	scv Beryllium	0.000012	ND	0.000012	ND
0.00203	wqc Cadmium	0.0002	ND	0.0006	
116	lcv Calcium	127		181	
0.231	wqc Chromium	0.000436	ND	0.000436	ND
0.023	scv Cobalt	0.000042	ND	0.000042	ND
0.029	wqc Copper	0.0034		0.0032	
1.0	wqc Iron	0.046	ND	0.046	ND
0.011	wqc Lead	0.004		0.003	
82.0	lcv Magnesium	32.2		45.4	
0.12	scv Manganese	0.141		0.158	
0.00077	wqc Mercury	0.0000045	ND	0.0000045	ND
0.168	wqc Nickel	0.00079	ND	0.00079	ND
53.0	lcv Potassium	3.89		5.13	
0.0050	wqc Selenium	0.000135	ND	0.000135	ND
0.0035	wqc Silver	0.000022	ND	0.000022	ND
680	lcv Sodium	77.4		93.9	
0.012	scv Thallium	0.000022	ND	0.000022	ND
0.020	scv Vanadium	0.001	ND	0.001	ND
0.382	wqc Zinc	0.137		0.732	
no benchmark	Hardness, as CaCO ₃	483		660	
no benchmark	Phosphate, Total (as P)	0.0106	ND	0.0106	ND
no benchmark	Total Suspended Solids	1.415	ND	1.415	ND
no benchmark	Nitrate, as N	0.0199		0.00345	ND
no benchmark	Chloride	181		198	
no benchmark	Sulfate	178		321	
no benchmark	Alkalinity, as CaCO ₃	184		204	
no benchmark	Total Dissolved Solids	740		908	

Notes:

Results in mg/L

Non-detects are reported at half the detection limit

Duplicate samples have been averaged

Samples were collected quarterly from November 2014 to October 2015

Samples analyzed for dissolved metals were field filtered by sample collectors

Key:

ID = Identification

mg/L = milligrams per liter

ND = not detected

OU2 = Richardson Flat Tailings Site Operable Unit 2

OU3 = Richardson Flat Tailings Site Operable Unit 3

SW = Surface Water

lcv = Lowest Chronic Value for daphnids

scv = Secondary Chronic Value

wqc = water quality criterion

Table E-2. Screening results for surface water samples compared with amphibian benchmarks

DRAFT

Sample ID						
Surface Water Chronic Benchmark (mg/L)	Operable Unit	Sample date	Habitat	N	count of NDs	% detected
Dissolved water						
0.005	Aluminum	91	91		0%	0.016
0.030	Antimony	91	4		95.6%	0.000474
0.0040	Arsenic	91	9		90.1%	0.000106
no benchmark	Barium	91	0		100%	0.0195
	Beryllium	91	91		0%	0.0000119
	Cadmium	91	46		49.5%	0.000171
	Nutrient	Calcium	91	0	100%	46
	0.0030	Chromium	91	90	1.1%	0.000436
	0.0050	Cobalt	91	91	0%	0.0000416
	0.0040	Copper	91	51	44.0%	0.000216
	no benchmark	Iron	91	84	7.7%	0.046
	0.0040	Lead	91	46	49.5%	0.000214
no benchmark	Nutrient	Magnesium	91	0	100%	11.1
	0.14	Manganese	91	1	98.9%	0.0006
	0.00010	Mercury	91	91	0%	0.0000026
	0.0050	Nickel	91	82	9.9%	0.00079
	Nutrient	Potassium	91	0	100%	1.4
	0.0090	Selenium	91	91	0%	0.000135
	0.0010	Silver	91	91	0%	0.0000217
	Nutrient	Sodium	91	0	100%	18.5
	no benchmark	Thallium	91	91	0%	0.0000217
no benchmark	no benchmark	Vanadium	91	90	1.1%	0.00053
	0.0010	Zinc	91	2	97.8%	0.0045
no benchmark	Hardness, as CaCO ₃	91	0		100%	161
	Phosphate, Total (as P)	91	56		38.5%	0.0106
	Total Suspended Solids	91	44		51.6%	1.415
	Nitrate, as N	91	32		64.8%	0.00345
	Chloride	91	0		100%	32.3
	Sulfate	91	0		100%	12.6
	Alkalinity, as CaCO ₃	91	0		100%	105
	Total Dissolved Solids	91	0		100%	256
						2190
						818

Table E-2. (cont.)

DRAFT

OU2 Samples										
Sample ID	OU2-0-SW-AIRF	OU2-0-SW-AIRF	OU2-0-SW-AIRF	OU2-0-SW-ASCWWT	OU2-0-SW-ASCWWT	OU2-0-SW-ASCWWT	OU2-0-SW-ASCWWT	OU2-0-SW-BIRF	OU2-0-SW-BIRF	OU2-0-SW-BIRF
Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
Sample date	3/9/2015	5/26/2015	8/31/2015	3/10/2015	5/26/2015	8/31/2015	10/8/2015	3/9/2015	5/26/2015	
Habitat	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream	ND
Dissolved water										
Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND
Antimony	0.008	0.006	0.008	0.009	0.006	0.019	0.021	0.008	0.006	0.006
Arsenic	0.006	0.006	0.009	0.004	0.005	0.022	0.013	0.005	0.006	0.006
Barium	0.053	0.049	0.047	0.048	0.043	0.053	0.055	0.053	0.048	0.048
Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND
Cadmium	0.004	0.002	0.0017	ND	0.005	0.003	0.00017	0.0005	0.002	0.002
Calcium	146	145	106	159	144	128	184	144	146	146
Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND
Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND
Copper	0.077	0.039	0.087	0.024	0.032	0.054	0.042	0.038	0.038	0.038
Iron	0.150	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046
Lead	0.027	0.004	0.009	0.003	0.003	0.003	0.008	0.003	0.003	0.003
Magnesium	35.1	34.9	27.9	36.1	35.0	34.5	47.2	34.8	35.2	
Manganese	0.209	0.159	0.052	0.249	0.157	0.305	0.360	0.206	0.185	
Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND
Nickel	0.00079	ND	0.00079	ND	0.00200	0.0079	0.0079	ND	0.00079	ND
Potassium	7.26	4.49	16.60	3.23	1.87	4.61	5.18	8.15	3.92	
Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND
Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
Sodium	185.0	135.0	203.0	159.0	102.0	81.8	98.2	186.0	126.0	
Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Zinc	1.510	0.880	0.140	1.790	0.827	0.282	0.658	1.410	0.972	
Hardness, as CaCO ₃	508	523	396	545	518	482	668	500	540	
Phosphate, Total (as P)	0.576	0.269	1.2	0.0106	ND	0.0106	ND	0.637	0.256	
Total Suspended Solids	4.8	1.415	ND	1.415	4	1.415	ND	1.415	6.4	4
Nitrate, as N	7.74	4.25	19.1	0.00345	ND	0.00345	ND	0.00345	8.44	3.58
Chloride	367	267	393	344	221	197	209	370	289	
Sulfate	194	215	123	209	222	176	320	176	216	
Alkalinity, as CaCO ₃	161	170	150	170	182	184	204	149	175	
Total Dissolved Solids	1260	1020	1040	1070	860	768	1020	1180	1140	

Table E-2. (cont.)

DRAFT

OU2 Samples										
Sample ID	OU2-0-SW-BIRF	OU2-0-SW-BIRF	OU2-0-SW-IRF	OU2-0-SW-IRF	OU2-0-SW-PPTRIB	OU2-0-SW-SC1	OU2-0-SW-SCBNPWR	OU2-0-SW-SCBNPWR	OU2-0-SW-SCBNPWR	Dups ave
Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
Sample date	8/31/2015	10/8/2015	3/9/2015	5/26/2015	3/9/2015	10/8/2015	3/11/2015	5/27/2015	9/1/2015	
Habitat	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream	
Dissolved water										
Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND
Antimony	0.012		0.017		0.004		0.006		0.005	
Arsenic	0.013		0.016		0.002		0.006		0.016	
Barium	0.047		0.053		0.030		0.049		0.158	
Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND
Cadmium	0.0002	ND	0.0006	ND	0.0002	ND	0.0022	ND	0.0002	ND
Calcium	107		143		264		144		69	
Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND
Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND
Copper	0.082		0.0063		0.0002		0.0039		0.0002	
Iron	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.114	
Lead	0.009		0.005		0.000		0.003		0.000	
Magnesium	28.0		34.7		64.9		33.9		15.2	
Manganese	0.066		0.251		0.538		0.163		0.192	
Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND
Nickel	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND
Potassium	16.00		10.50		12.70		4.40		10.30	
Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND
Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
Sodium	196.0		143.0		75.2		131.0		32.4	
Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Zinc	0.168		0.461		0.064		0.895		0.005	
Hardness, as CaCO ₃	409		501		935		531		230	
Phosphate, Total (as P)	1.17		0.771		0.265		0.3		0.253	
Total Suspended Solids	1.415	ND	3.2		7.6		3.2		1.415	
Nitrate, as N	17.9		10.9		1.31		3.89		0.943	
Chloride	381		263		309		259		90.4	
Sulfate	128		221		460		206		12.6	
Alkalinity, as CaCO ₃	150		164		159		173		167	
Total Dissolved Solids	964		1030		1480		948		408	
									388	
									904	
									884	
									672	

Table E-2. (cont.)

DRAFT

OU2 Samples									
Sample ID	OU2-0-SW-SCBNPRR	OU2-0-SW-SCI	OU2-0-SW-SCI	OU2-0-SW-SCI	OU2-0-SW-SCI80	OU2-0-SW-SCI80	OU2-0-SW-SCI80	OU2-0-SW-SCI80	OU2-0-SW-SCI80
Operable Unit	OU2		OU2		OU2		OU2		Dups ave
Sample date	10/8/2015		3/9/2015		5/26/2015		8/31/2015		3/9/2015
Habitat	Stream		Stream		Stream		Stream		Stream
Dissolved water									
Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016
Antimony	0.018	0.005	0.005	0.005	0.010	0.007	0.018	0.020	0.020
Arsenic	0.009	0.014	0.012	0.013	0.007	0.008	0.020	0.022	0.022
Barium	0.042	0.120	0.130	0.139	0.063	0.056	0.077	0.077	0.077
Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012
Cadmium	0.0008	0.0002	ND	0.0002	ND	0.0036	0.0028	0.0002	0.0007
Calcium	180	64	70	60	141	146	96	132	
Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436
Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042
Copper	0.0033	0.0002	ND	0.0002	ND	0.0027	0.0042	0.0057	0.0055
Iron	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.119
Lead	0.007	0.003	0.004	0.005	0.000	ND	0.010	0.006	0.016
Magnesium	46.3	16.1	16.3	15.0	33.9	34.6	24.8	31.9	
Manganese	0.114	0.111	0.069	0.029	0.264	0.214	0.108	0.298	
Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045
Nickel	0.00079	ND	0.00079	ND	0.00079	ND	0.00079	ND	0.00079
Potassium	5.00	3.84	2.79	2.13	6.05	3.59	12.70	9.41	
Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135
Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022
Sodium	94.7	21.7	25.8	24.2	153.0	115.0	149.5	120.5	
Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022
Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001
Zinc	0.672	0.048	0.041	0.065	1.710	1.095	0.296	0.513	
Hardness, as CaCO ₃	649	219	240	221	486	505	358	463	
Phosphate, Total (as P)	0.0106	ND	0.122	0.0579	0.0106	ND	0.347	0.181	0.864
Total Suspended Solids	1.415	ND	6	1.415	ND	4.20	2.71	1.42	ND
Nitrate, as N	0.00345	ND	0.582	0.52	0.0129	ND	4.71	2.11	13.6
Chloride	191	65.5	71.5	63.7	331	240	300	222	
Sulfate	313	25.6	26.5	19.1	173	208	98	188	
Alkalinity, as CaCO ₃	199	159	163	161	165	182	161	180	
Total Dissolved Solids	968	332	408	312	1055	942	862	860	

Table E-2. (cont.)

DRAFT

OU2 Samples								
Sample ID	OU2-0-SW-SCWWT	OU2-0-SW-SCWWT	OU2-0-SW-SCWWT	OU2-0-SW-SCWWT	OU2-0-SW-SCDINF	OU2-0-SW-SPRRP	OU2-0-SW-STRGD	
	Dups ave							
Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	
Sample date	3/10/2015	5/26/2015	8/31/2015	10/8/2015	3/10/2015	3/10/2015	3/10/2015	
Habitat	Stream	Stream	Stream	Stream	Stream	Stream	Stream	
Dissolved water								
Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND
Antimony	0.000	ND	0.002	0.002	0.003	0.012	0.009	0.003
Arsenic	0.003	0.003	0.004	0.004	0.009	0.011		0.003
Barium	0.060	0.065	0.049	0.051	0.031	0.044		0.076
Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND
Cadmium	0.0006	0.0009	0.0002	0.0002	0.0093	0.0002	0.0002	0.0018
Calcium	116	138	106	99	411	46		219
Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND
Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND
Copper	0.0077	0.0057	0.0083	0.0088	0.0041	0.0002	0.0002	ND
Iron	0.046	ND	0.046	ND	0.046	ND	0.125	0.046
Lead	0.006	0.002	0.005	0.004	0.000	0.004	0.000	ND
Magnesium	28.8	34.5	27.6	23.6	88.1	12.3		54.2
Manganese	0.048	0.035	0.013	0.011	0.335	0.053	0.171	
Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND
Nickel	0.00079	ND	0.00079	ND	0.00079	ND	0.00079	ND
Potassium	14.80	13.30	18.20	16.70	2.37	3.66		2.86
Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND
Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
Sodium	213.5	240.0	224.0	210.0	107.0	19.5		172.0
Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Zinc	0.260	0.299	0.069	0.099	3.150	0.485	0.668	
Hardness, as CaCO ₃	405	493	395	355	1330	162		738
Phosphate, Total (as P)	1.62	1.3	1.45	1.66	0.0106	ND	0.0548	0.0106
Total Suspended Solids	12.0	6	1.415	ND	4.8	4.4	1.415	ND
Nitrate, as N	20.6	17.2	22.9	23.9	0.00345	ND	0.00345	ND
Chloride	392	448	427	329	387	32.3		532
Sulfate	141	187	117	111	723	31.8		111
Alkalinity, as CaCO ₃	133	136	145	139	267	127		249
Total Dissolved Solids	1065	1270	1100	1060	1730	352		1390

Table E-2. (cont.)

DRAFT

OU3 Samples										
Sample ID	OU3-SW-ASCAOU4	OU3-SW-HS	OU3-SW-MRUBP	OU3-SW-MRUBP	OU3-SW-MRUBP	OU3-SW-MRUBP	OU3-SW-NGCF	OU3-SW-NPCWR	OU3-SW-NPCWR	Dups ave
Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
Sample date	3/16/2015	3/11/2015	11/12/2014	3/13/2015	5/28/2015	9/2/2015	3/11/2015	3/10/2015	5/27/2015	
Habitat	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream	ND
Dissolved water										
Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND
Antimony	0.005	0.000	ND	0.005	0.005	0.006	0.004	0.000	ND	0.008
Arsenic	0.003	0.000	ND	0.000	ND	0.003	0.000	ND	0.000	0.005
Barium	0.034	0.132	0.022	0.032	0.037	0.029	0.397	0.049	0.045	
Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND
Cadmium	0.0022	0.0002	ND	0.0005	0.0015	0.0007	0.0002	ND	0.00044	0.0037
Calcium	67	48	94	87	94	88	269	160	156	
Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND
Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND
Copper	0.0031	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0024
Iron	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046	ND
Lead	0.002	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000
Magnesium	13.5	11.4	14.2	15.4	15.3	13.9	80.1	36.3	36.8	
Manganese	0.046	0.001	ND	0.088	0.069	0.100	0.153	0.017	0.244	0.197
Mercury	0.0000045	ND	0.0000045	ND	0.0000026	ND	0.0000045	ND	0.0000045	ND
Nickel	0.00079	ND	0.00079	ND	0.00212	0.0079	0.0079	ND	0.0079	ND
Potassium	1.89	3.51	2.15	2.48	2.21	1.88	11.00	3.14	1.74	
Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND
Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
Sodium	104.0	18.5	60.4	110.0	112.0	58.9	356.0	159.0	107.0	
Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
Vanadium	0.001	ND	0.006	0.001	ND	0.001	ND	0.001	ND	0.001
Zinc	0.544	0.005	ND	0.610	0.542	0.305	0.117	0.010	1.670	1.455
Hardness, as CaCO ₃	232	161	296	277	306	299	934	536	519	
Phosphate, Total (as P)	0.0106	ND	0.125	0.0106	ND	0.0106	ND	0.0106	ND	0.011
Total Suspended Solids	6.4	9.2	3.6	3.6	3.6	7.2	1.415	4.4	1.4	ND
Nitrate, as N	0.0109	0.76	0.253	0.0804	0.115	0.016	0.00345	ND	0.00345	0.0035
Chloride	189	44.1	112	180	198	117	939	349	219	
Sulfate	93.1	14.2	166	135	137	113	58.3	221	223	
Alkalinity, as CaCO ₃	107	116	114	120	108	130	234	179	186	
Total Dissolved Solids	468	256	400	576	628	448	2140	1080	902	

Table E-2. (cont.)

DRAFT

OU3 Samples										
Sample ID	OU3-0-SW-NPCWR	OU3-0-SW-NPCWR	OU3-0-SW-SC1C	OU3-0-SW-SC1C	OU3-0-SW-SC1C	OU3-0-SW-SC1C	OU3-0-SW-SC248AC	OU3-0-SW-SC248AC	OU3-0-SW-SC248AC	OU3-0-SW-SC248AC
Operable Unit	OU3		OU3		OU3		OU3		OU3	
Sample date	8/31/2015		10/8/2015		3/11/2015		5/27/2015		9/1/2015	
Habitat	Stream		Stream		Stream		Stream		Stream	
Dissolved water										
Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND
Antimony	0.017		0.020		0.007		0.006		0.008	
Arsenic	0.017		0.010		0.003		0.007		0.009	
Barium	0.053		0.051		0.044		0.034		0.054	
Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND
Cadmium	0.0002	ND	0.0005	ND	0.0020	ND	0.0016	ND	0.0002	ND
Calcium	130		180		136		131		118	
Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND
Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND
Copper	0.041		0.035		0.002		0.024		0.002	
Iron	0.046	ND	0.046	ND	0.046	ND	0.234	ND	0.046	ND
Lead	0.004		0.005		0.000		0.021		0.003	
Magnesium	34.7		46.2		32.5		31.6		29.5	
Manganese	0.288		0.292		0.062		0.152		0.459	
Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND
Nickel	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND	0.0079	ND
Potassium	4.58		5.13		2.70		1.58		2.70	
Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND
Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
Sodium	81.3		94.8		155.0		86.4		68.6	
Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Zinc	0.202		0.638		0.549		0.287		0.054	
Hardness, as CaCO ₃	488		642		459		420		449	
Phosphate, Total (as P)	0.0106	ND	0.0106	ND	0.0106	ND	0.0106	ND	0.0106	ND
Total Suspended Solids	1.415	ND	1.415	ND	1.415	ND	5.2		5.6	
Nitrate, as N	0.0312		0.00345	ND	0.00345	ND	0.0218		0.00345	
Chloride	199		212		285		157		156	
Sulfate	184		321		206		212		156	
Alkalinity, as CaCO ₃	189		203		138		133		184	
Total Dissolved Solids	712		1000		816		648		608	
									616	
									792	
									768	
									1550	

Table E-2. (cont.)

DRAFT

OU3 Samples										
Sample ID	OU3-0-SW-SC248AC	OU3-0-SW-SC248BC	OU3-0-SW-SC248BC	OU3-0-SW-SC248BC	OU3-0-SW-SC248BC	OU3-9-SW-SC248BC	OU3-0-SW-SC248NRB	OU3-0-SW-SC248NRB	OU3-0-SW-SC248NRB	
Operable Unit	OU3		Dups ave		Dups ave		OU3		OU3	
Sample date	10/9/2015		3/13/2015		5/28/2015		9/1/2015		10/9/2015	
Habitat	Stream		Stream		Stream		Stream		Stream	
Dissolved water										
Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND
Antimony	0.006		0.005		0.005		0.007		0.006	
Arsenic	0.009		0.004		0.005		0.010		0.006	
Barium	0.121		0.039		0.033		0.052		0.045	
Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND
Cadmium	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND
Calcium	205		159		119		118		128	
Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND
Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND
Copper	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND
Iron	0.154		0.046		0.046		0.046		0.046	
Lead	0.000	ND	0.000	ND	0.000	ND	0.002		0.004	
Magnesium	48.1		37.3		29.8		28.5		31.3	
Manganese	0.968		0.489		0.200		0.481		0.411	
Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND
Nickel	0.00079	ND	0.00079	ND	0.00079	ND	0.00079	ND	0.00079	ND
Potassium	2.03		2.57		1.66		2.56		2.32	
Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND
Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
Sodium	172.0		112.0		70.2		68.6		57.2	
Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Zinc	0.672		0.365		0.235		0.087		0.169	
Hardness, as CaCO ₃	644		557		397		444		425	
Phosphate, Total (as P)	0.0106	ND	0.035		0.011	ND	0.0718		0.0106	ND
Total Suspended Solids	1.415	ND	2.7		3.4		7.2		1.415	ND
Nitrate, as N	0.00345	ND	0.060		0.013		0.013		0.00345	ND
Chloride	397		224		144		140		106	
Sulfate	233		267		214		145		232	
Alkalinity, as CaCO ₃	210		161		135		181		161	
Total Dissolved Solids	1230		914		642		600		636	
									700	
									832	
									848	
									608	

Table E-2. (cont.)

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OU3 Samples

Sample ID	OU3-0-SW-SCAOU4	OU3-0-SW-SCAOU4	OU3-0-SW-SCAOU4	OU3-0-SW-SCBOU4	OU3-0-SW-SCBOU4	OU3-9-SW-SCBOU4	OU3-0-SW-SCBOU4	OU3-0-SW-SCHFTR	OU3-0-SW-SCHFTR
Operable Unit	OU3								
Sample date	11/12/2014	5/28/2015	9/2/2015	11/12/2014	3/16/2015	3/16/2015	5/28/2015	3/13/2015	5/28/2015
Habitat	Stream								
Dissolved water									
Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016
Antimony	0.006	0.006	0.006	0.005	0.005	0.004	0.006	0.007	0.005
Arsenic	0.003	0.004	0.003	0.002	0.000	ND	0.003	0.004	0.006
Barium	0.020	0.036	0.025	0.022	0.036	0.035	0.037	0.040	0.031
Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012
Cadmium	0.0008	0.0002	ND	0.0006	0.0006	0.0016	0.0015	0.0008	0.0002
Calcium	64	78	68	95	102	98	92	108	116
Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436
Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042
Copper	0.0002	ND	0.0023	0.0002	ND	0.0002	ND	0.0002	ND
Iron	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046
Lead	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.002
Magnesium	11.1	13.5	11.4	14.2	17.2	16.6	15.3	25.5	28.0
Manganese	0.018	0.052	0.047	0.077	0.118	0.116	0.092	0.287	0.146
Mercury	0.0000026	ND	0.0000045	ND	0.0000045	ND	0.0000045	ND	0.0000045
Nickel	0.00079	ND	0.00079	ND	0.00208	0.00234	0.00216	0.00079	ND
Potassium	1.47	1.74	1.40	2.23	2.77	2.72	2.14	2.49	1.72
Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135
Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022
Sodium	28.3	98.6	30.7	61.6	155.0	152.0	109.0	117.0	69.5
Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022
Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001
Zinc	0.338	0.108	0.200	0.623	0.945	0.944	0.333	0.323	0.162
Hardness, as CaCO ₃	208	254	230	309	307	305	298	381	416
Phosphate, Total (as P)	0.0106	ND	0.0106	ND	0.251	0.0106	ND	0.0106	ND
Total Suspended Solids	6	12.4	11.6	119	10.8	4.4	5.6	5.6	4
Nitrate, as N	0.152	0.0701	0.0332	0.251	0.0927	0.101	0.15	0.082	0.0333
Chloride	50.4	182	62.5	113	237	243	187	208	136
Sulfate	89	101	83.7	127	154	160	127	166	204
Alkalinity, as CaCO ₃	108	105	118	115	116	115	112	132	138
Total Dissolved Solids	280	452	292	492	664	700	580	720	620

Table E-2. (cont.)

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OU3 Samples

Table E-2. (cont.)

DRAFT

OU3 Samples										
Sample ID	OU3-0-SW-SCRFR	OU3-0-SW-SCRFR	OU3-0-SW-SCRFR	OU3-0-SW-SCRFR	OU3-0-SW-SCURTFB	OU3-0-SW-SCURTFB	OU3-0-SW-SCURTFB	OU3-0-SW-SCURTFB	OU3-0-SW-SCURTFB	OU3-9-SW-SCURTFB
Dups ave										
Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
Sample date	11/12/2014	3/13/2015	5/28/2015	9/1/2015	11/12/2014	3/13/2015	5/28/2015	9/2/2015	9/2/2015	9/2/2015
Habitat	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream
Dissolved water										
Aluminum	0.016	ND	0.016	ND	0.016	ND	0.016	ND	0.016	ND
Antimony	0.005		0.007		0.006		0.007		0.005	
Arsenic	0.004		0.003		0.005		0.007		0.006	
Barium	0.036		0.038		0.030		0.050		0.034	
Beryllium	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND	0.000012	ND
Cadmium	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND
Calcium	113		101		107		101		110	
Chromium	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND	0.000436	ND
Cobalt	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND	0.000042	ND
Copper	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND	0.0002	ND
Iron	0.046	ND	0.046	ND	0.046	ND	0.046	ND	0.046	ND
Lead	0.000	ND	0.000	ND	0.000	ND	0.000	ND	0.000	ND
Magnesium	23.1		22.3		24.2		22.0		20.7	
Manganese	0.256		0.245		0.140		0.442		0.128	
Mercury	0.0000026	ND	0.0000045	ND	0.0000045	ND	0.0000026	ND	0.0000045	ND
Nickel	0.00079	ND	0.00079	ND	0.00079	ND	0.00079	ND	0.00079	ND
Potassium	2.56		2.51		1.96		2.76		2.21	
Selenium	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND	0.000135	ND
Silver	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
Sodium	67.5		126.0		97.9		72.1		62.0	
Thallium	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND	0.000022	ND
Vanadium	0.001	ND	0.001	ND	0.001	ND	0.001	ND	0.001	ND
Zinc	0.174		0.402		0.165		0.115		0.205	
Hardness, as CaCO ₃	410		346		376		353		374	
Phosphate, Total (as P)	0.0614		0.0106	ND	0.0106	ND	0.0878		0.054	
Total Suspended Solids	5.6		5.6		1.415		8		12.0	
Nitrate, as N	0.018		0.0593		0.00345	ND	0.00345	ND	0.22	
Chloride	133		215		183		137		126	
Sulfate	193		175		174		140		184	
Alkalinity, as CaCO ₃	144		129		126		159		130	
Total Dissolved Solids	640		708		672		616		484	
									327	
									330	
									325	
									325	
									0.05	
									0.0106	
									ND	
									4	
									3.6	
									0.0271	
									0.0281	
									122	
									123	
									130	
									132	
									135	
									135	
									532	

Table E-2. (cont.)

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OU3 Samples						
Sample ID	OU3-0-SW-SPCWR	OU3-0-SW-SPCWR	OU3-0-SW-SPCWR	OU3-0-SW-SPCWR	OU3-0-SW-SPCWR	OU3-0-SW-SPCWR
Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3
Sample date	3/10/2015	5/27/2015	8/31/2015	10/8/2015		
Habitat	Stream	Stream	Stream	Stream	Stream	Stream
Dissolved water						
Aluminum	0.016	ND	0.016	ND	0.016	ND
Antimony	0.008		0.005		0.011	0.018
Arsenic	0.004		0.005		0.015	0.008
Barium	0.049		0.041		0.049	0.044
Beryllium	0.000012	ND	0.000012	ND	0.000012	ND
Cadmium	0.0039		0.0020		0.0002	ND
Calcium	158		153		127	181
Chromium	0.000436	ND	0.000436	ND	0.000436	ND
Cobalt	0.000042	ND	0.000042	ND	0.000042	ND
Copper	0.0024		0.0030		0.0034	0.0032
Iron	0.046	ND	0.046	ND	0.046	ND
Lead	0.002		0.000		0.004	0.003
Magnesium	35.9		36.6		32.2	45.4
Manganese	0.206		0.132		0.141	0.158
Mercury	0.0000045	ND	0.0000045	ND	0.0000045	ND
Nickel	0.00079	ND	0.00079	ND	0.00079	ND
Potassium	3.18		1.74		3.89	5.13
Selenium	0.000135	ND	0.000135	ND	0.000135	ND
Silver	0.000022	ND	0.000022	ND	0.000022	ND
Sodium	159.0		104.0		77.4	93.9
Thallium	0.000022	ND	0.000022	ND	0.000022	ND
Vanadium	0.001	ND	0.001	ND	0.001	ND
Zinc	1.350		0.928		0.137	0.732
Hardness, as CaCO ₃	528		502		483	660
Phosphate, Total (as P)	0.0106	ND	0.0106	ND	0.0106	ND
Total Suspended Solids	1.415	ND	1.415	ND	1.415	ND
Nitrate, as N	0.00345	ND	0.00345	ND	0.0199	0.00345
Chloride	346		207		181	198
Sulfate	215		214		178	321
Alkalinity, as CaCO ₃	175		186		184	204
Total Dissolved Solids	1040		812		740	908

Notes:

Results in mg/L

Non-detects are reported at half the detection limit

Duplicate samples have been averaged

Samples were collected quarterly from November 2014 to October 2015

Samples analyzed for dissolved metals were field filtered by sample collectors

Key:

ID = Identification

mg/L = milligrams per liter

ND = not detected

OU2 = Richardson Flat Tailings Site Operable Unit 2

OU3 = Richardson Flat Tailings Site Operable Unit 3

SW = Surface Water

Table E-3. Screening results for sediment samples compared with sediment toxicity benchmarks for benthic macroinvertebrates

DRAFT

Sample ID							
Sediment Toxicity Benchmarks for Benthic Macroinvertebrates		Operable Unit					
		Sample date					
(mg/kg)	Habitat	N	count of NDs	# detected	Minimum	Maximum	Average
25519	tel Aluminum	14	0	100%	1450	36000	10621
2	erl Antimony	14	0	100%	24.0	287	149
10	tec Arsenic	14	0	100%	27.2	464	206
no benchmark	Barium	14	0	100%	60.1	514	185
no benchmark	Beryllium	14	14	0%	0.0037	0.012	0.0055
1	tec Cadmium	14	0	100%	13.4	131	63.4
Nutrient	Calcium	14	0	100%	7350	58050	31991
43	tec Chromium	14	4	71%	1.6	66.5	25.3
no benchmark	Cobalt	14	0	100%	2.3	29.9	11.6
32	tec Copper	14	0	100%	37.00	428	232
188400	tel Iron	14	0	100%	10100	105000	27805
36	tec Lead	14	0	100%	47.3	7715	4046
Nutrient	Magnesium	14	0	100%	2430	16050	9755
631	tel Manganese	14	0	100%	279	6710	2253
0	tec Mercury	14	1	93%	0.0019	11.9	4.0
23	tec Nickel	14	13	7%	1.4	44.1	5.1
Nutrient	Potassium	14	0	100%	651	7280	2606
no benchmark	Selenium	14	13	7%	0.34	62.8	5.0
1	erl Silver	14	1	93%	0.014	35.7	19.8
Nutrient	Sodium	14	1	93%	5.1	881	408
no benchmark	Thallium	14	12	14%	0.0031	5.45	0.63
no benchmark	Vanadium	14	0	100%	5.5	57.9	21.6
121	tec Zinc	14	0	100%	1650	32800	12436
no benchmark	Phosphate, Total (as P)	14	0	100%	452	2130	1310
no benchmark	Percent Moisture (%)	14	0	100%	18.9	75.0	38.3

Table E-3. (cont.)

DRAFT

OU2 Samples					
Sample ID	OU2-0-SD-BIRF	OU2-0-SD-IRF	OU2-0-SD-SCBNPRR	OU2-0-SD-SCI	OU2-0-SD-SCWWT
Operable Unit	OU2	OU2	OU2	Dups avg OU2	Dups avg OU2
Sample date	7/27/2015	7/27/2015	7/28/2015	7/27/2015	7/28/2015
Habitat	Stream	Stream	Stream	Stream	Stream
Aluminum	5770	3010	10200	7120	4250
Antimony	251	128	108	249	187.5
Arsenic	254	103	142	194	442
Barium	64.4	118	246	60.05	110.25
Beryllium	0.003975	ND	0.00565	ND	0.0044125
Cadmium	67.9	34.2	59.4	95.4	85
Calcium	41000	29300	27800	50050	58050
Chromium	34.8	2.31	ND	27.7	39.05
Cobalt	2.32	6.21	27.8	4.765	2.535
Copper	317	133	125	358.5	427.5
Iron	12200	10100	23200	17250	15420
Lead	4670	1840	2330	5920	7715
Magnesium	10500	5820	12000	12170	16050
Manganese	1370	1430	6160	2135	1735
Mercury	7.82	2.02	3.69	3.405	1.845
Nickel	1.46	ND	2.08	ND	1.6225
Potassium	1590	984	1160	2645	1465
Selenium	0.364	ND	0.52	ND	0.4025
Silver	22.7	9.68	19.4	33.7	29.4
Sodium	362	340	403	281.75	196.5
Thallium	0.00337	ND	0.004805	ND	5.451945
Vanadium	10.7	7.08	29.5	11.5	3.3115625
Zinc	19000	6430	10300	21000	18250
Phosphate, Total (as P)	1390	452	1270	1665	1380
Percent Moisture (%)	22.1	45	32.7	35.1	18.85

Table E-3. (cont.)

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OU3 Samples									
Sample ID	OU3-0-SD-MRUBP	OU3-0-SD-NPCWR	OU3-0-SD-SC1C	OU3-0-SD-SC248AC	OU3-0-SD-SC248NRB	OU3-0-SD-SCRF72	OU3-0-SD-SCRFR	OU3-0-SD-SCURTFB	OU3-0-SD-SPCWR
Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
Sample date	11/12/2014	7/28/2015	7/28/2015	7/28/2015	7/28/2015	7/28/2015	11/12/2014	11/12/2014	7/28/2015
Habitat	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream	Stream
Aluminum	23500	5040	36000	10200	13200	5110	1450	18000	5840
Antimony	37.8	287	24	60.9	151	124	171	93.35	220
Arsenic	63.3	464	27.2	91	76.3	275	413	120	213
Barium	181	384	514	79	176	112	144	203.5	195
Beryllium	0.01185	ND	0.0059	ND	0.003935	ND	0.0052	ND	0.003895
Cadmium	84.7	131	13.4	57.7	26.3	55	78.2	34.35	64.7
Calcium	21400	35300	8170	40700	7350	10400	21200	52650	44500
Chromium	45.5	2.42	ND	66.5	35.4	21.8	2.09	ND	22.6475
Cobalt	9.72	16.1	12.9	11.5	5.02	17.8	29.9	9.475	7
Copper	180	348	37	144	233	143	272	213	312
Iron	19200	25500	28200	39500	14100	34700	105000	21300	23600
Lead	1070	7410	47.3	2580	3450	4440	6540	2415	6220
Magnesium	9670	13600	7770	12600	5630	2430	9280	7550	11500
Manganese	385	6710	2490	1060	279	3210	1340	982.5	2260
Mercury	1.85	6.83	0.122	1.92	11.9	7.48	0.00189	ND	2.5125
Nickel	4.35	ND	2.175	ND	44.1	1.91	ND	1.43	ND
Potassium	5850	1440	7280	1900	3050	1130	651	5095	2250
Selenium	1.085	ND	0.545	ND	0.3385	ND	0.476	ND	0.4075
Silver	12.3	35.7	0.0139	ND	12.4	15.1	11.1	28.2	20.5
Sodium	876	269	881	415	504	244	5.05	ND	313
Thallium	0.01005	ND	0.00505	ND	0.003135	ND	0.004415	ND	0.003305
Vanadium	52	6.41	57.9	20.1	23.7	7.76	18.7	44.85	6.37
Zinc	7460	32800	1650	10500	4470	12400	12000	5440	12400
Phosphate, Total (as P)	1300	1500	1480	1260	1170	841	1270	1230	2130
Percent Moisture (%)	75	47.1	25	20.8	41	41.4	23.4	72.5	36.3

Notes:

Samples were collected November 2014 by RMC and July 2015 by UPCM

All samples analyzed as bulk samples by laboratory

Results reported as mg/kg

Non-detects are reported at half the detection limit

Duplicate samples have been averaged

Sediment samples collected from surficial materials (upper 1 inch)

Key:

ID = Identification

mg/kg = milligrams per kilogram - dry

ND = Non-Detect

OU2 = Richardson Flat Tailings Site Operable Unit 2

OU3 = Richardson Flat Tailings Site Operable Unit 3

RMC = Resource and Environmental Management Consultants, Inc.

SD = Sediment

UPCM = United Park City Mines

tel: threshold effect level

erl: effect range low

tec: threshold effect concentration

Table E-4a. Screening results for OU2 Floodplain soil samples compared with benchmarks for effects to soil inverts and plants

DRAFT

Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Sample ID	Depth	Operable Unit	Sample date	Habitat	N	count of NDs	% detected	Minimum	Maximum	Average	OU2-0-SO-10E-0.501	OU2-0-SO-10L-0	OU2-0-SO-10L-0.501	OU2-0-SO-12I-0	OU2-0-SO-12I-0.501	
												9/17/2015	Floodplain	9/21/2015	Floodplain	9/17/2015	Floodplain
50	Aluminum	84	0	100%	2040	36800	14153	30200	38.6	403	16.7	0.173	ND	1550	18200	5590	
5	Antimony	84	14	83%	0.154	5490	27400	41.9	10.5	403	31400	10.0	ND	1350	1440	1440	
18	Arsenic	84	0	100%	3.26	7010	491	272	195	235	206	227	229	5300	5300	5300	
330	Barium	84	0	100%	40	1360	272	195	206	235	227	229	229	229	229	229	
10	Beryllium	84	84	0%	0.0022	0.006525	0	0.00268	ND	0.00302	ND	0.00283	ND	0.00249	ND	0.003215	ND
32	Cadmium	84	2	98%	0.00785	206	60	5.76	5790	6830	5340	39100	206	195	5810	5810	5810
Nutrient	Calcium	84	0	100%	4970	117000	32806	35.3	34.1	30.9	123	123	123	20.1	20.1	20.1	
0.40	Chromium	84	2	98%	1.02	123	34	34.9	30.9	34.1	35.3	35.3	35.3	33.7	33.7	33.7	
13	Cobalt	84	1	99%	0.16625	33.7	9	9.63	5.77	7.96	7.96	3.97	3.97	2450	1950	1950	
70	Copper	84	1	99%	0.775	2725	509	79.1	34.9	21.8	21.8	2450	2450	138000	138000	138000	
200	Iron	84	0	100%	3340	138000	28976	26100	20500	21100	21100	24000	24000	34400	34400	34400	
120	Lead	84	2	98%	14.95	47000	7416	544	15.2	ND	23.5	34400	34400	29700	29700	29700	
Nutrient	Magnesium	84	0	100%	2700	40000	10738	5870	6220	5950	17700	17700	17700	2700	2700	2700	
220	Manganese	84	0	100%	142	5910	1769	888	183	317	3650	3650	3650	2450	2450	2450	
0.10	Mercury	84	7	92%	0.000625	201.5	12	0.452	0.202	0.0512	31.3	31.3	31.3	89.6	89.6	89.6	
38	Nickel	84	75	11%	0.81	24.4	3	0.985	ND	1.11	ND	0.915	ND	1.18	ND	1.18	
Nutrient	Potassium	84	0	100%	848	9670	3892	6060	7520	7910	6500	1310	1310	1310	1310	1310	
1.0	Selenium	84	47	44%	0.2225	34.6	6	0.2455	ND	0.2765	ND	0.2595	ND	20.5	13.1	13.1	
50.0	Silver	84	20	76%	0.0094	236	40	4.65	0.01135	ND	0.01065	ND	236	102	102	102	
Nutrient	Sodium	84	4	95%	3.935	3430	468	428	1020	735	473	658	658	658	658	658	
1.0	Thallium	84	42	50%	0.002063	45.7	5	0.002275	ND	0.00256	ND	0.0024	ND	11.9	5.91	5.91	
2.0	Vanadium	84	5	94%	0.0745	122	26	53.5	40.3	42.3	42.3	41.8	41.8	0.0925	ND	0.0925	
120	Zinc	84	0	100%	55.3	65600	12186	666	1370	90.4	31300	31300	31300	43700	43700	43700	
no benchmark	Phosphate, Total (as P)	84	0	100%	261	5180	1439	725	905	624	3710	3710	3710	1310	1310	1310	

Table E-4a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-12L-0	OU2-0-SO-12L-0.501	OU2-0-SO-13H-0.501	OU2-0-SO-14C-0.501	OU2-0-SO-15L-0	OU2-0-SO-15L-0.501	OU2-0-SO-15N-0	OU2-0-SO-15N-0.501	OU2-0-SO-16H-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0.501	0.501	0	0.501	0	0.501	0.501
	Operable Unit Sample date Habitat	OU2 9/21/2015 Floodplain	OU2 9/21/2015 Floodplain	OU2 9/17/2015 Floodplain	OU2 9/22/2015 Floodplain	OU2 9/17/2015 Floodplain	OU2 9/17/2015 Floodplain	OU2 9/16/2015 Floodplain	OU2 9/16/2015 Floodplain	OU2 9/17/2015 Floodplain
50	Aluminum	7900	36600	20000	33000	3350	15900	6830	6060	27200
5	Antimony	874	10.2	0.1695	0.193	847	830	304	351	5.75
18	Arsenic	649	14.5	7.73	9.56	757	449	258	383	12
330	Barium	185	285	165	323	63.8	137	236	393	244
10	Beryllium	0.00264	ND	0.00297	ND	0.00278	ND	0.00316	ND	0.00437
32	Cadmium	79.6	18.9	0.00785	ND	1.42	175	77	37.4	55.5
Nutrient	Calcium	25000	7710	4970	5840	74700	48300	42000	39300	9110
0.40	Chromium	30	37.1	31	39.2	1.785	54	34.5	32.7	35.1
13	Cobalt	2.69	10.6	9.26	11.8	7.29	2	6.91	5.32	14.3
70	Copper	1670	42.3	18.9	30.2	252	1090	385	540	29
200	Iron	15300	25200	18300	28100	11200	13400	31600	43400	26200
120	Lead	16900	14.95	ND	19.1	28.7	1830	17600	7680	7630
Nutrient	Magnesium	8680	7440	4930	6280	3610	10900	14300	15100	5750
220	Manganese	1730	788	576	846	350	1720	1670	1990	932
0.10	Mercury	26	0.172	0.0506	0.000755	1.88	6	9.38	8.03	0.207
Nutrient	Nickel	0.97	ND	1.09	ND	1.02	ND	1.45	ND	1.05
1.0	Potassium	2350	9670	4880	7870	942	5250	2280	2450	6240
50.0	Selenium	10.2	0.272	ND	0.2545	ND	0.2895	ND	10.8	16.3
Nutrient	Silver	120	0.0112	ND	0.01045	ND	0.0119	ND	0	ND
1.0	Sodium	399	919	389	737	1350	239	41.3	42.8	0.0115
2.0	Thallium	0.00224	ND	0.00252	ND	0.002355	ND	24.9	7	3.98
2.0	Vanadium	18.9	44	41	56.4	5.9	33	18.8	19.9	5.49
120	Zinc	20300	2780	59.5	107	65600	12300	11100	9620	61
no benchmark	Phosphate, Total (as P)	1460	931	862	867	419	2090	2050	1830	685

Table E-4a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-17L-0	OU2-0-SO-17L-0.501	OU2-0-SO-17N-0	OU2-0-SO-17N-0.501	OU2-0-SO-23O-0.501	OU2-0-SO-25R-0.501	OU2-0-SO-26O-0.501	OU2-0-SO-26S-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0.501	0.501	0.501	0.501
	Operable Unit	OU2	OU2	OU2	OU2	Dups ave	Dups ave	Dups ave	Dups ave
	Sample date	9/17/2015	9/17/2015	9/16/2015	9/16/2015	9/16/2015	9/16/2015	9/15/2015	9/15/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	30200	36800	3580	4070	7525	3760	20500	11600
5	Antimony	11.4	0.194	ND	413	928	577.5	223	1500
18	Arsenic	23.8	7.19	ND	406	701	514	310	909.5
330	Barium	319	284	99.4	83.4	189	134	112.45	263
10	Beryllium	0.002705	ND	0.003175	ND	0.0026	ND	0.00308	ND
32	Cadmium	4.08	1.14	ND	69	83.6	89.8	79.5	113.65
Nutrient	Calcium	7300	6420	43500	40100	42300	40400	16090	30300
0.40	Chromium	39.3	34.9	17.7	19.8	45.1	19.1	85.05	25.5
13	Cobalt	11.8	8.03	2.2	3.12	6.88	6.35	0.16625	ND
70	Copper	46.2	24.6	579	671	771.5	380	2580	1210
200	Iron	34800	26400	11100	15300	26200	45200	17050	59300
120	Lead	272	16	7900	15100	10550	5590	35300	14700
Nutrient	Magnesium	6140	7340	12000	10300	10350	15000	10205	11500
220	Manganese	1070	635	2100	2930	2375	2250	517.5	1860
0.10	Mercury	0.424	0.000885	ND	8.23	9.01	15.5	3.63	38.9
38	Nickel	18.6	1.165	ND	0.955	ND	0.98	0.905	ND
Nutrient	Potassium	6150	8480	1270	2190	2245	1660	4360	2150
1.0	Selenium	0.248	ND	0.2905	ND	0.238	ND	0.245	ND
50.0	Silver	1.6	0.01195	ND	55.2	90.8	58.15	32.7	218.5
Nutrient	Sodium	944	659	162	413	394	151	407.5	367
1.0	Thallium	0.002295	ND	0.002695	ND	5.33	3.81	4.38	4.677675
2.0	Vanadium	40.6	51.9	11.4	13.5	22.8	10.8	45.5	24.5
120	Zinc	427	86.7	17200	18500	17450	16700	21250	18300
no benchmark	Phosphate, Total (as P)	863	767	1660	1280	895.5	504	2985	1530

Table E-4a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-26V-0	OU2-0-SO-26V-0.501	OU2-0-SO-30R-0	OU2-0-SO-30R-0.501	OU2-0-SO-30U-0.501	OU2-0-SO-30Y-0	OU2-0-SO-30Y-0.501	OU2-0-SO-31X-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0.501	0	0.501	0.501
	Operable Unit Sample date Habitat	OU2 9/16/2015 Floodplain	OU2 9/16/2015 Floodplain	OU2 9/15/2015 Floodplain	OU2 9/15/2015 Floodplain	OU2 9/15/2015 Floodplain	OU2 9/16/2015 Floodplain	OU2 9/16/2015 Floodplain	OU2 8/5/2015 Floodplain
50	Aluminum	3370	4770	5600	6150	5320	4610	4220	6320
5	Antimony	132	189	489	395	269	234	197	290
18	Arsenic	217	240	335	295	245	335	317	337
330	Barium	161	258	119	53.7	125	184	115	159
10	Beryllium	0.00264	ND	0.00267	ND	0.00246	ND	0.002445	ND
32	Cadmium	27.3	42.3	54	47.9	44.7	93.1	52	75.8
Nutrient	Calcium	38100	45700	27500	29900	41400	57000	55400	43800
0.40	Chromium	20.6	24	26	20.5	26.4	25.9	38	23.4
13	Cobalt	2.5	2.6	2.2	1.61	12.6	8.04	5	11.5
70	Copper	125	237	873	698	303	337	219	413
200	Iron	16100	26700	10400	10100	18700	46500	32200	46600
120	Lead	2810	4130	13900	8090	4150	6410	3710	5530
Nutrient	Magnesium	14900	17000	7660	6480	12800	18500	19300	11200
220	Manganese	1700	1940	1420	1370	5080	2460	1650	1560
0.10	Mercury	1.65	4.17	17.7	10.5	3.93	4.82	2	6.78
38	Nickel	0.97	ND	0.98	ND	0.905	ND	0.93	ND
Nutrient	Potassium	1440	2170	1560	1900	1690	2070	1930	1830
1.0	Selenium	0.2415	ND	9.07	0.2255	ND	0.2325	ND	20.1
50.0	Silver	17	23.7	60.6	44.6	19.8	34.2	29	23.8
Nutrient	Sodium	127	213	280	222	168	278	242	270
1.0	Thallium	0.00224	ND	4.13	3.33	3.93	3.96	0	ND
2.0	Vanadium	10.4	13.5	11.6	13	7.85	15.2	12	0.828
120	Zinc	4430	6940	17200	13400	8160	15400	8160	17200
no benchmark	Phosphate, Total (as P)	1480	1460	1390	1120	1100	1330	1400	1260

Table E-4a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-32V-0.501	OU2-0-SO-33F-0.501	OU2-0-SO-33X-0.501	OU2-0-SO-34G-0	OU2-0-SO-34G-0.501	OU2-0-SO-34Z-0.501	OU2-0-SO-35V-0	OU2-0-SO-35V-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0.501	0.501	0	0.501	0.501	0	0.501
	Dups ave	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
	Sample date	8/5/2015	8/5/2015	8/5/2015	8/5/2015	8/5/2015	8/5/2015	8/5/2015	8/5/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	6135	35900	4840	7530	27400	3410	12000	27000
5	Antimony	254.5		140	63		165	45.2	0.2135
18	Arsenic	237		253	110		282	206	20.6
330	Barium	97.1	322	97	159	287	176	196	288
10	Beryllium	0.00324	ND	0.002705	0	0.00263	ND	0.00252	ND
32	Cadmium	32.45		1.27	66	63.6	1.46	54.6	17.5
Nutrient	Calcium	29300	5300	53800	41400	5490	44500	24200	7900
0.40	Chromium	20.2	44	22	10.9	33.5	16.8	15	32.1
13	Cobalt	3.825	13.9	5	12.2	12.1	5.54	14.5	9.01
70	Copper	421	27.6	244	126	33.1	287	89.7	19.1
200	Iron	12200	32000	26400	11900	24100	35000	26100	20700
120	Lead	3780	36	4620	605	44.6	4090	1110	27.3
Nutrient	Magnesium	7310	6920	15600	3480	5390	15400	4670	7620
220	Manganese	1520	860	1520	1770	803	1400	2420	148
0.10	Mercury	6.845	ND	0.0444	2	0.642	5.3	4.79	0.000745
38	Nickel	1.19	22.3	1	ND	0.965	18.3	1.19	ND
Nutrient	Potassium	1730	6970	1960	1900	5580	1460	2910	5990
1.0	Selenium	0.29675	ND	0.2475	11	0.2405	ND	15	0.32
50.0	Silver	13.95	0.0102	ND	23	5.58	0.0095	23.7	0.01315
Nutrient	Sodium	202.5	448	4	ND	202	450	126	707
1.0	Thallium	5.665	0.002295	ND	0	7.29	0.002135	4.36	0.002965
2.0	Vanadium	9.365	67.4	5	ND	14.1	55.4	17.4	49.4
120	Zinc	9030	107	10200	7970	124	11800	2680	164
no benchmark	Phosphate, Total (as P)	1165	751	1110	1040	710	780	913	796

Table E-4a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-37V-0	OU2-0-SO-37V-0.501	OU2-0-SO-39V-0	OU2-0-SO-39V-0.501	OU2-0-SO-43T-0	OU2-0-SO-43T-0.501	OU2-0-SO-44T-0	OU2-0-SO-44T-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0	0.501
Operable Unit Sample date Habitat	OU2 8/5/2015 Floodplain	OU2 8/5/2015 Floodplain	OU2 8/4/2015 Floodplain	OU2 8/4/2015 Floodplain	OU2 8/4/2015 Floodplain	OU2 8/4/2015 Floodplain	OU2 9/14/2015 Floodplain	OU2 9/14/2015 Floodplain	OU2 9/14/2015 Floodplain
50 Aluminum	20000	25600	12800	29500	2940	26000	6960	15300	
5 Antimony	24.8	0.226	ND	320	105	3.78	0.155	ND	353
18 Arsenic	48.7	11.8		306	76.2	4.23	11.8	413	581
330 Barium	269	271		336	256	77.7	245	248	482
10 Beryllium	0.0025	ND	0.003695	ND	0.00244	ND	0.002495	ND	0.002535
32 Cadmium	5.52	1.11		55.3	17.6	3	2.39	127	103
Nutrient Calcium	27800	7230	15000	7960	117000	6360	48800	75100	
0.40 Chromium	24	33.4	22.5	44.4	1.02	ND	33.1	28	65
13 Cobalt	8.61	8.29	27.9	7.39	1.88	9.81	9	7.56	
70 Copper	76.7	22.6	411	278	31.5	19.8	806	817	
200 Iron	20100	19300	20900	22100	3340	22900	39300	49300	
120 Lead	616	28.3	9200	4140	51.6	56.4	10600	12400	
Nutrient Magnesium	6790	7450	4000	6240	4650	5920	13300	33900	
220 Manganese	266	152	3850	380	2820	593	2050	2710	
0.10 Mercury	1.8	0.00073	ND	23.9	18.9	0.298	0.245	14	14
38 Nickel	0.92	ND	1.36	ND	0.895	ND	0.915	ND	1.075
Nutrient Potassium	5070	6680	3630	6530	1540	5680	2240	6850	
1.0 Selenium	0.229	ND	0.3385	ND	8.57	0.2475	ND	0.2285	
50.0 Silver	3.48	0.0139	ND	24.7	14.7	0.0094	ND	0.232	ND
Nutrient Sodium	587	670	278	538	788	613	400	534	
1.0 Thallium	0.002125	ND	0.00314	ND	0.00207	ND	0.002295	ND	0.00215
2.0 Vanadium	31.8	45.6	25.8	51.4	5.56	54.1	9	20.3	
120 Zinc	995	131	6590	1450	289	131	31800	14900	
no benchmark Phosphate, Total (as P)	721	1060	1320	938	844	629	1740	2640	

Table E-4a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-44V-0	OU2-0-SO-44V-0.501	OU2-0-SO-44W-0	OU2-0-SO-44W-0.501	OU2-0-SO-45T-0	OU2-0-SO-45T-0.501	OU2-0-SO-45V-0	OU2-0-SO-45V-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0	0.501
	Operable Unit Sample date Habitat	OU2 7/31/2015 Floodplain	OU2 7/31/2015 Floodplain	OU2 7/31/2015 Floodplain	OU2 7/31/2015 Floodplain	OU2 7/30/2015 Floodplain	OU2 7/30/2015 Floodplain	OU2 7/30/2015 Floodplain	OU2 7/30/2015 Floodplain
50	Aluminum	20500	7730	10200	11000	11300	6410	6470	3650
5	Antimony	570	291	344	479	513	219	224	177
18	Arsenic	550	363	442	395	589	296	241	245
330	Barium	298	314	224	223	330	148	171	74.4
10	Beryllium	0.003105	ND	0.003085	ND	0.00328	ND	0.002865	ND
32	Cadmium	86.5	65.1	180	82.5	105	43.4	65.4	126
Nutrient	Calcium	41800	51300	44700	55600	69600	52400	50200	48000
0.40	Chromium	65.4	35.4	30.3	62.2	49.5	25	33.3	20.9
13	Cobalt	13.5	8.23	21.4	5.95	13.5	6.62	4.99	2.53
70	Copper	1080	412	650	685	845	270	437	318
200	Iron	33700	45800	25800	23500	37500	34000	21300	9870
120	Lead	9720	6620	4800	12600	11400	4700	5490	4670
Nutrient	Magnesium	14600	16800	10300	14500	15800	16400	16200	17100
220	Manganese	2750	2340	3200	2190	2280	2270	2310	2230
0.10	Mercury	26.5	7.3	9.27	8.42	10.8	3.73	3.27	2.97
38	Nickel	22.6	1.135	ND	23.5	1.05	ND	0.87	ND
Nutrient	Potassium	6030	3380	3250	4680	4330	2520	2830	1400
1.0	Selenium	14.3	14.1	0.3005	ND	9.15	15.6	9.91	8.2
50.0	Silver	72.3	37.3	41.3	57.9	81.3	23.2	26.8	19.5
Nutrient	Sodium	387	239	3430	619	204	361	115	4.33
1.0	Thallium	21.6	7.12	45.7	6.08	14.1	6.62	5.9	0.00227
2.0	Vanadium	30.7	3.87	14.5	18.5	14.3	3.02	8.5	5.99
120	Zinc	26600	11300	29800	18000	18000	7720	14600	11100
no benchmark	Phosphate, Total (as P)	2550	2060	261	2330	1490	1360	1060	418

Table E-4a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-46R-0.501	OU2-0-SO-46T-0.501	OU2-0-SO-46V-0	OU2-0-SO-46V-0.501	OU2-0-SO-47T-0	OU2-0-SO-47T-0.501	OU2-0-SO-48S-0	OU2-0-SO-48S-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0.501	0	0.501	0	0.501	0	0.501
	Operable Unit Sample date Habitat	OU2 7/30/2015 Floodplain							
50	Aluminum	8450	3740	5310	6760	9190	15400	7330	2040
5	Antimony	416	357	332	509	269	651	267	118
18	Arsenic	553	481	743	580	360	1010	314	685
330	Barium	310	239	160	98.3	212	1360	196	64.8
10	Beryllium	0.003495	ND	0.00265	ND	0	ND	0.006	ND
32	Cadmium	66.5	71.8	62	75.8	118	126	101	24.3
Nutrient	Calcium	48800	48100	40400	51300	25600	95000	52900	25100
0.40	Chromium	36.9	22	26	36.4	29	69.5	27.5	11.1
13	Cobalt	12.6	9.23	7	6.94	9	15.4	9.9	1.79
70	Copper	698	559	278	460	494	987	387	173
200	Iron	34900	27400	27500	26000	22700	75700	28800	8560
120	Lead	8490	6500	4220	8700	5600	15000	5920	1860
Nutrient	Magnesium	12900	13100	13900	13300	7060	40000	13700	7170
220	Manganese	2350	5910	2300	2450	1010	4390	1950	1080
0.10	Mercury	9.74	4.41	3	5.13	13	12.9	3.61	1.86
38	Nickel	1.285	ND	0.975	ND	1	ND	2.21	ND
Nutrient	Potassium	3290	1460	2210	2460	2410	7480	2740	848
1.0	Selenium	14.2	8.84	8	0.269	ND	20	34.6	9.49
50.0	Silver	58.9	21	22	45.1	27	82.3	28.2	10.9
Nutrient	Sodium	213	4.295	ND	119	140	391	618	376
1.0	Thallium	9.16	7.82	4	4.31	23	21.4	10.3	0.002675
2.0	Vanadium	8.47	1.98	3	8.57	13	13.2	9.21	2.78
120	Zinc	14000	12200	13200	17800	19400	20200	27900	6790
no benchmark	Phosphate, Total (as P)	668	1680	1670	2970	3480	3850	1240	1090

Table E-4a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-48T-0	OU2-0-SO-48T-0.501	OU2-0-SO-4A-0	OU2-0-SO-4A-0.501	OU2-0-SO-50P-0	OU2-0-SO-50Q-0	OU2-0-SO-50Q-0.501	OU2-0-SO-50R-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0	0.501	0.501
	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
	Sample date	7/30/2015	7/30/2015	9/24/2015	9/24/2015	7/29/2015	7/29/2015	7/29/2015	7/29/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	6640	9840	31200	30200	30600	7320	5700	4680
5	Antimony	5490	441	12.4	0.1545	6.6	276	482	232
18	Arsenic	7010	251	22.2	10.9	11.9	247	2040	669
330	Barium	575	96.3	458	281	312	166	439	152
10	Beryllium	0.00358	ND	0.00392	ND	0.00294	ND	0.002525	ND
32	Cadmium	66.1	88.5	3.68	1	2.395	44.8	98.6	111
Nutrient	Calcium	14900	58500	6170	5840	7775	50200	38000	48000
0.40	Chromium	20	47	37.7	35.5	34.4	28.1	25.5	26.1
13	Cobalt	11.3	7.81	11.5	13.1	10.8	5.92	19.1	15.5
70	Copper	396	645	48.1	25.1	40.8	352	430	308
200	Iron	130000	35500	26700	28100	26200	17900	74100	48000
120	Lead	3810	8380	271	18.2	160.5	4730	6640	5710
Nutrient	Magnesium	3440	21100	5670	5370	6410	11900	14900	12200
220	Manganese	1680	2410	1070	739	765.5	1730	2330	1930
0.10	Mercury	1.57	7.83	0.643	0.00073	ND	0.228	10.7	7.27
Nutrient	Nickel	1.315	ND	1.44	ND	20.1	21.6	1.1275	ND
	Potassium	2310	4900	7710	6290	6555	2430	2080	1510
1.0	Selenium	0.3275	ND	15	0.2695	ND	0.2315	ND	0.2805
50.0	Silver	21.1	56.9	1.63	0.0095	ND	0.01155	ND	33.8
Nutrient	Sodium	335	143	487	636	710.5	242	288	4.21
1.0	Thallium	35.4	12.7	0.002495	ND	0.002145	ND	4.6	7.72
2.0	Vanadium	0.0825	ND	10.9	58.8	50.3	12.1	0.11	0.002755
120	Zinc	22200	15000	515	92.9	274	10400	19000	0.075
no benchmark	Phosphate, Total (as P)	519	2140	1020	1040	1450	1360	1770	2030

Table E-4a. (cont.)

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	Sample ID	OU2-0-SO-50T-0	OU2-0-SO-50T-0.501	OU2-0-SO-51P-0.501	OU2-0-SO-7C-0.501	OU2-0-SO-7F-0	OU2-0-SO-7F-0.501	OU2-0-SO-8G-0	OU2-0-SO-8G-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0.501	0.501	0	0.501	0	0.501
	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	Dups ave
	Sample date	7/30/2015	7/30/2015	7/29/2015	9/22/2015	9/17/2015	9/17/2015	9/17/2015	9/17/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	35800	15900	21300	25700	8860	16100	9090	11100
5	Antimony	0.1895	ND	0.184	0.2945	ND	490	826	1150
18	Arsenic	11.3		3.26	8.57		449	1020	889
330	Barium	262		184	293		249		
10	Beryllium	0.0031	ND	0.00301	ND	0.00482	ND	0.002665	ND
32	Cadmium	1.3		0.00855	ND	1.88		0.002975	ND
Nutrient	Calcium	6300		19400	9390		22800	41900	43000
0.40	Chromium	40.4		47.5	30.3		72.6	50.2	78.3
13	Cobalt	11.4		7.25	8.68		5.62	3.41	2.63
70	Copper	22.8		0.775	33.9		854	1010	1770
200	Iron	27300		20600	22200		23700	19600	20900
120	Lead	75.1		16.1	91		13000	27400	31200
Nutrient	Magnesium	6910		5450	5510		12600	14200	15200
220	Manganese	667		142	494		1220	2740	2130
0.10	Mercury	0.0463		0.000625	ND	0.198		6.3	16.3
38	Nickel	20.9		1.105	ND	1.77		1.365	ND
Nutrient	Potassium	6480		2870	6580		6810	3590	6440
1.0	Selenium	0.284	ND	0.276	ND	0.4415	ND	9.2	9.53
50.0	Silver	0.0117	ND	0.01135	ND	0.01815	ND	88.7	169
Nutrient	Sodium	520		621	633		564	327	418
1.0	Thallium	0.00263	ND	0.002555	ND	0.00409	ND	12.8	6.25
2.0	Vanadium	60		53.3	51.7		49.7	21.6	4.95
120	Zinc	122		55.3	198		9900	27900	23200
no benchmark	Phosphate, Total (as P)	1450		1470	1150		2290	5180	2120
									1660
									2075

Table E-4a. (cont.)

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	Sample ID	OU2-0-SO-8I-0	OU2-0-SO-8I-0.501	OU2-0-SO-OP1-0-0	OU2-0-SO-OP1-0-0.501	OU2-0-SO-OP2-0-0	OU2-0-SO-OP2-0-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501
	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2
	Sample date	9/21/2015	9/21/2015	7/29/2015	7/29/2015	9/17/2015	9/17/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
	Dups ave						
50	Aluminum	5200	4105	11200	13400	27200	30900
5	Antimony	257	296	244	55	8.27	0.205
18	Arsenic	292	258	268	58.3	16.8	9.72
330	Barium	57.4	40	269	241	450	386
10	Beryllium	0.002505	ND	0.0024275	ND	0.00329	0.002765
32	Cadmium	44.8	51.35	42.2	15	2	1.18
Nutrient	Calcium	42900	39100	17300	14100	8500	7340
0.40	Chromium	28.4	25.05	23.5	25.1	31.4	33.4
13	Cobalt	2.42	1.805	3.57	4.45	11.4	9.97
70	Copper	358	393	550	155	58.1	22.4
200	Iron	11200	8805	19200	18500	25100	26100
120	Lead	6260	5270	9960	1510	176	15.5
Nutrient	Magnesium	12200	9430	5970	7430	6390	6730
220	Manganese	2110	1885	832	684	641	397
0.10	Mercury	5.64	2.895	7.22	5.4	0.372	0.000955
38	Nickel	0.92	ND	0.8925	ND	1.015	ND
Nutrient	Potassium	1820	1300	3250	3490	6060	7270
1.0	Selenium	0.2295	ND	0.2225	ND	0.253	ND
50.0	Silver	32.2	38.65	35.8	10.1	0.0104	ND
Nutrient	Sodium	176	156	578	566	794	812
1.0	Thallium	0.002125	ND	0.0020625	ND	0.002345	ND
2.0	Vanadium	11	8.855	122	47	39.6	45.7
120	Zinc	12100	10235	8250	2700	272	87.2
no benchmark	Phosphate, Total (as P)	1430	1385	1580	1120	883	900

Notes:

Samples were collected November 2014 to October 2015

All samples analyzed by laboratory as bulk samples.

Results reported as mg/kg

Non-detects are reported at half the detection limit

Duplicate samples have been averaged

Sampling Depth:

0 is a surface sample; collected at 0-2 inches

0.501 is taken between 6 inches and 1 foot beneath surface

Benchmarks are the lowest value of the EcoSSLs for plants and soil invertebrates, or the ORNL LOEC for plants, soil organisms, and microbes

Key:

ID = Identification

mg/kg = milligrams per kilogram

ND = Non-Detect

OU2 = Richardson Flat Tailings Site Operable Unit 2

SO = Soil

Table E-4b. Screening results for OU2 Upland soil samples compared with benchmarks for effects to soil inverts and plants

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Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Sample ID	Depth	Operable Unit	Sample date	Habitat	N	count of NDs	% detected	Minimum	Maximum	Average	OU2-0-SO-	OU2-0-SO-	OU2-0-SO-	OU2-0-SO-	OU2-0-SO-
												12B-0.501	12N-0.501	140-0.501	15D-0.501	17F-0.501
50	Aluminum	37	0	100%	6790	48500	29070	34000	6960	23300	28900	36300				
5	Antimony	37	13	65%	0.147	2610	164	0.1835	ND	279	12.9	7.96	0.174			
18	Arsenic	37	0	100%	6.87	799	102	8.4	284	18.1	17.1	12				
330	Barium	37	0	100%	90.3	400	273	369	191	304	351	330				
10	Beryllium	37	37	0%	0.002405	0.003265	0	0.00301	ND	0.00242	ND	0.0025	ND	0.0029	ND	0.002845
32	Cadmium	37	0	100%	0.916	395	30	1.47	48.3	3.87	2.43	1.23				
Nutrient	Calcium	37	0	100%	1890	31000	8047	6300	31000	7480	5950	5940				
0.40	Chromium	37	0	100%	18.6	83.7	38	33.5	28.4	36.7	40.3	42.4				
13	Cobalt	37	0	100%	2.82	16.7	11	13.5	7.86	10.5	14.9	13.7				
70	Copper	37	1	97%	14	2310	231	31.4	390	43.7	31	18				
200	Iron	37	0	100%	9970	74700	26756	27400	26400	23300	26400	24700				
120	Lead	37	0	100%	13.9	32900	2625	17.3	6490	218	114	29.4				
Nutrient	Magnesium	37	0	100%	1130	14000	6433	6620	14000	4840	5790	6790				
220	Manganese	37	0	100%	170	2580	1073	869	2390	942	1180	1020				
0.10	Mercury	37	12	68%	0.0006	104	7	0.000775	ND	6.37	0.904	0.187	0.000715	ND		
38	Nickel	37	21	43%	0.89	35.9	10	1.38	ND	0.89	0.92	ND	1.33	ND	21.1	
Nutrient	Potassium	37	0	100%	1550	9460	6210	7310	2530	6170	6230	8000				
1.0	Selenium	37	33	11%	0.2205	10.3	1	0.2755	ND	10.3	0.229	ND	0.266	ND	0.2605	ND
50.0	Silver	37	21	43%	0.00905	196	19	0.0113	ND	32.8	1.68	0.01095	ND	0.0107	ND	
Nutrient	Sodium	37	0	100%	203.5	3370	636	854	228	649	932	1170				
1.0	Thallium	37	33	11%	0.00204	4.72	0	0.002555	ND	3.73	0.00212	ND	0.002465	ND	0.002415	ND
2.0	Vanadium	37	0	100%	10.9	75.2	53	51.2	21	62.1	59.4	55				
120	Zinc	37	1	97%	22.9	65300	4331	84.4	9550	429	162	85.2				
no benchmark	Phosphate, Total (as P)	37	0	100%	391	1650	894	768	1620	1190	648	586				

Table E-4b. (cont.)

DRAFT

	Sample ID	OU2-0-SO-17H-0.501	OU2-0-SO-18H-0.501	OU2-0-SO-19W-0.501	OU2-0-SO-21D-0	OU2-0-SO-21D-0.501	OU2-0-SO-24I-0.501	OU2-0-SO-27I-0	OU2-0-SO-27I-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0.501	0.501	0	0.501	0.501	0	0.501
	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
	Sample date	9/17/2015	9/17/2015	9/16/2015	9/22/2015	9/22/2015	9/15/2015	9/15/2015	9/15/2015
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	27900	30200	23700	29400	32500	22100	39000	48500
5	Antimony	31.8	95.35		12.3		0	ND	0.158
18	Arsenic	42.8	95.55		23.9		11.3	13	11.4
330	Barium	255	276	257	289	284	358	300	400
10	Beryllium	0.00262	ND	0.0025125	ND	0.00253	ND	0.002465	ND
32	Cadmium	5.17	12.2	1.27	4.39	1.06	1	1.15	1.02
Nutrient	Calcium	6360	6090	4800	6870	4730	4700	5050	5690
0.40	Chromium	32.8	37.9	31.2	39.6	41.6	28	36.6	41
13	Cobalt	8.25	10.23	10.9	10.4	13.2	15	11.9	12.4
70	Copper	72.9	183	23.9	55.5	24	14	23.1	15.1
200	Iron	25100	23300	74700	22500	26300	23400	28400	32000
120	Lead	587	1915		359		19.4	32.7	23.6
Nutrient	Magnesium	5750	5670	4370	5220	5150	4950	6470	8270
220	Manganese	759	1185	853	738	823	1730	1040	1230
0.10	Mercury	0.51	1.84		0.367		0.00073	ND	0.000745
38	Nickel	0.965	ND	9.1525	17.2	1.05	ND	20.1	19.2
Nutrient	Potassium	6910	7170	5550	7590	7490	4200	9210	8690
1.0	Selenium	0.24	ND	0.23	ND	0.2615	ND	0.226	ND
50.0	Silver	4.73	13.75	0.00955	ND	2.35	0.0093	ND	0.00975
Nutrient	Sodium	489	478.5	444	765	620	385	450	390
1.0	Thallium	0.002225	ND	0.0021325	ND	0.00215	ND	0.002095	ND
2.0	Vanadium	49.5	55.8	60.6	55.2	61.3	56	59.6	63
120	Zinc	613	1640	68.5	597	102	44	87.6	76.7
no benchmark	Phosphate, Total (as P)	1120	826	926	1250	1060	1050	590	391

Table E-4b. (cont.)

DRAFT

	Sample ID	OU2-0-SO-28L-0.501	OU2-0-SO-28N-0.501	OU2-0-SO-28P-0.501	OU2-0-SO-29F-0	OU2-0-SO-29F-0.501	OU2-0-SO-2A-0	OU2-0-SO-2A-0.501	OU2-0-SO-30H-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0.501	0.501	0	Dups ave	0	0.501	0.501
	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
	Sample date	9/15/2015	9/15/2015	9/15/2015	9/15/2015	9/15/2015	9/22/2015	9/22/2015	9/15/2015
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	25100	45700	23100	31800	46200	36100	34200	39400
5	Antimony	0.1535	ND	5.19	123	5.3	0.16675	ND	2610
18	Arsenic	9.76	15.1	87.5	14.6	10.265	760	17.6	17.1
330	Barium	187	290	195	316	334.5	289	320	395
10	Beryllium	0.002515	ND	0.00252	ND	0.00284	ND	0.00273	ND
32	Cadmium	1.05	6.21	51.9	2.34	1.08	40.7	16	3.28
Nutrient	Calcium	6270	6260	8900	6710	6265	1890	10300	5970
0.40	Chromium	41	40.5	35.4	44.6	42.65	34.2	35.3	83.7
13	Cobalt	7.73	11.5	8.02	12.9	10.24	5.36	9.66	13.7
70	Copper	14.8	17.6	237	40.4	19.6	2230	38.7	42.6
200	Iron	29300	33100	24900	25400	31850	9970	24500	31900
120	Lead	13.9	44.7	2830	171	18.15	20400	61.8	75.1
Nutrient	Magnesium	6420	7940	6110	6000	8595	1130	7810	7060
220	Manganese	170	880	623	1030	654.5	1770	407	1270
0.10	Mercury	0.00067	ND	0.0972	2.54	0.11	0.0006925	ND	0.0895
38	Nickel	0.925	ND	20.1	0.965	ND	12.9	2.01	31.4
Nutrient	Potassium	4140	8650	5350	7650	7350	1690	9030	8570
1.0	Selenium	0.2305	ND	0.2305	ND	0.2405	ND	0.247	ND
50.0	Silver	0.00945	ND	0.0095	ND	18.7	0.010275	ND	0.00975
Nutrient	Sodium	656	443	734	652	594	3370	770	523
1.0	Thallium	0.002135	ND	0.00214	ND	0.00223	ND	0.00229	ND
2.0	Vanadium	62.8	74	52.6	60.7	65.3	28.2	42.2	71.1
120	Zinc	65.7	701	10900	230	80	18600	1330	233
no benchmark	Phosphate, Total (as P)	1110	623	1340	858	449	865	805	912

Table E-4b. (cont.)

DRAFT

	Sample ID	OU2-0-SO-31L-0.501	OU2-0-SO-32N-0.501	OU2-0-SO-32R-0.501	OU2-0-SO-33I-0.501	OU2-0-SO-33L-0.501	OU2-0-SO-33N-0.501	OU2-0-SO-34N-0.501	OU2-0-SO-34S-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0.501	0.501	0.501	0.501	0.501	0.501	Dups ave
	Operable Unit	OU2							
	Sample date	8/4/2015	8/4/2015	8/4/2015	8/5/2015	8/5/2015	8/4/2015	8/4/2015	8/4/2015
	Habitat	Upland							
50	Aluminum	21600	28400	20500	39100	35600	33500	35800	7335
5	Antimony	220	65.9	0.19	ND	0.1675	ND	68.8	9.34
18	Arsenic	224	71.2	20.2		8.16	10.6	66.6	16.6
330	Barium	106	262	297		326	311	266	277
10	Beryllium	0.003245	ND	0.003025	ND	0.00311	ND	0.00274	ND
32	Cadmium	23.5	14.1	1.18		1.42	0.975	6.61	2.65
Nutrient	Calcium	10100	8620	5240		7300	6420	8010	5930
0.40	Chromium	18.6	35.5	34.5	40.5	40.6	42.8	41	31
13	Cobalt	4.3	12.1	13.1		11.9	12.9	12.2	11.1
70	Copper	404	145	17.5	36.1	17.1	127	38.2	1325
200	Iron	21800	22300	24000	28300	26500	25800	26000	15000
120	Lead	3580	1310		14.2	25.4	21.3	1310	15900
Nutrient	Magnesium	6150	5860	5090	7940	9120	6740	6920	9410
220	Manganese	750	1070	1250	749	797	714	881	2500
0.10	Mercury	4.64	1.63		0.000735	ND	0.00076	ND	1.16
38	Nickel	1.19	ND	1.11	ND	1.14	ND	21.5	ND
Nutrient	Potassium	4970	6110	3300	9460	6830	7300	8520	1965
1.0	Selenium	0.2975	ND	0.277	ND	0.2845	ND	0.251	ND
50.0	Silver	32	8.58	0.0117	ND	0.0103	ND	0.01015	ND
Nutrient	Sodium	365	374	605	745	484	565	498	204
1.0	Thallium	0.002755	ND	4.66	0.00264	ND	0.002325	ND	0.002655
2.0	Vanadium	46.2	48	75.2	53.9	58.6	57.9	58.1	17
120	Zinc	4360	2340	294	111	22.9	ND	1290	27600
no benchmark	Phosphate, Total (as P)	1290	714	650	732	568	657	650	1455

Table E-4b. (cont.)

DRAFT

	Sample ID	OU2-0-SO-35N-0.501	OU2-0-SO-35S-0.501	OU2-0-SO-37S-0.501	OU2-0-SO-39S-0.501	OU2-0-SO-3B-0	OU2-0-SO-3B-0.501	OU2-0-SO-4B-0	OU2-0-SO-4B-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0.501	0.501	0.501	0	Dups ave	0	0.501
Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
Sample date	9/14/2015	8/4/2015	8/4/2015	8/4/2015	9/24/2015	9/24/2015	9/24/2015	9/24/2015	9/24/2015
Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	33600	30600	33000	29400	21500	26200	8310	6790
5	Antimony	9.6	32.9	184	4	18.1	0.1555	ND	1290
18	Arsenic	12.7	43.2	172	13	21.9	10.7	799	103
330	Barium	229	231	313	276	230	292	181	136
10	Beryllium	0.002535	ND	0.00254	ND	0	0.00258	ND	0.0025425
32	Cadmium	3.03	5.58	19.9	1	3.34	1.047	293	395
Nutrient	Calcium	5810	5610	7800	3950	5560	5275	15200	15300
0.40	Chromium	35.4	35.3	46.2	36	35.8	41.35	29.2	23.9
13	Cobalt	9.32	8.45	12.1	16	10.8	16.7	6.17	5.05
70	Copper	28.8	81.5	332	21	56.2	23	2310	18.05
200	Iron	25800	22900	24900	26600	23100	25150	28100	28900
120	Lead	64.2	644	3360	215	485	34.55	32900	3650
Nutrient	Magnesium	7510	6010	7380	6750	4310	4875	5080	3920
220	Manganese	749	713	1350	1420	945	1379	2580	291
0.10	Mercury	0.0493	0.696	2.52	0	0.799	0.0872	104	71.2
38	Nickel	18.7	0.935	ND	1.2	19	0.945	ND	1.105
Nutrient	Potassium	7340	6640	7710	5670	5360	5475	2090	1550
1.0	Selenium	0.232	ND	0.2325	ND	0	0.236	ND	9.6
50.0	Silver	0.00955	ND	5.02	28.9	0	ND	ND	8.82
Nutrient	Sodium	499	340	450	350	463	438	765	792
1.0	Thallium	0.00215	ND	0.002155	ND	0	0.00219	ND	0.002555
2.0	Vanadium	58.1	48.4	55.6	72	50.7	58.25	16.6	10.9
120	Zinc	196	695	2940	126	633	90.65	65300	8280
no benchmark	Phosphate, Total (as P)	520	651	819	638	1280	623	1650	1210

Notes:

Samples were collected November 2014 to October 2015

All samples analyzed by laboratory as bulk samples.

Results reported as mg/kg

Non-detects are reported at half the detection limit

Duplicate samples have been averaged

Sampling Depth:

0 is a surface sample; collected at 0-2 inches

0.501 is taken between 6 inches and 1 foot beneath surface

Benchmarks are the lowest value of the EcoSSLs for plants and soil invertebrates, or the ORNL LOEC for plants, soil organisms, and microbes

Key:

ID = Identification

mg/kg = milligrams per kilogram

ND = Non-Detect

OU2 = Richardson Flat Tailings Site Operable Unit 2

SO = Soil

Table E-4c. Screening results for OU3 Floodplain soil samples compared with benchmarks for effects to soil inverts and plants

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Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Sample ID								OU3-0-SO-ER-10S-0	OU3-0-SO-ER-10S-0.501	OU3-0-SO-ER-12R-0	OU3-0-SO-ER-12R-0.501	OU3-0-SO-ER-1J-0.501
	Depth								0	0.501	0	0.501	0.501
	Operable Unit Sample date	Habitat	N	count of NDs	% detected	Minimum	Maximum	Average	OU3 9/11/2015 Floodplain	OU3 9/11/2015 Floodplain	OU3 9/14/2015 Floodplain	OU3 9/14/2015 Floodplain	OU3 8/5/2015 Floodplain
50	Aluminum	149	0	100%	2.08	52200	21074	25100	26800	28100	32750	27700	
5	Antimony	149	16	89%	0.157	1800	210	69.4	0.1605	ND	16.7	6.41	11.65
18	Arsenic	149	0	100%	0.0809	1250	192	57.1	7.57	19.5	13.5		26.5
330	Barium	149	0	100%	2.7	871	280	293	293	204	375.5	199	
10	Beryllium	149	142	5%	0.0023	0.00683	0	0.0028	ND	0.002625	ND	0.002365	ND
32	Cadmium	149	1	99%	0.0105	198	43	7.2	1.03	2.91	1.565	2.12	
Nutrient	Calcium	149	0	100%	5.43	176000	26477	12500	6910	7330	6005	5375	
	Chromium	149	2	99%	1.195	143	39	31.9	33.7	29.4	33.95	38.4	
13	Cobalt	149	0	100%	0.152	31.3	10	9.98	9.5	8.26	12.425	10.8	
70	Copper	149	2	99%	0.96	3140	371	136	20.1	40.5	23.2	42.3	
200	Iron	149	0	100%	4.09	97500	26712	21900	20900	24100	28550	25550	
120	Lead	149	0	100%	20.6	40700	4578	1330	20.6	244	56.95	183.5	
Nutrient	Magnesium	149	0	100%	2.51	36300	10045	6200	6230	5440	6295	5030	
	Manganese	149	0	100%	6.69	15800	1788	640	414	693	1520.5	695.5	
0.10	Mercury	149	8	95%	0.00067	2950	42	1.52	0.00079	ND	0.253	0.06555	0.1495
38	Nickel	149	96	36%	0.845	28.5	7	1.03	ND	0.965	ND	0.87	ND
Nutrient	Potassium	149	0	100%	0.884	10100	5311	5820	6450	6810	15.2975	17.25	
	Selenium	149	103	31%	0.2165	28.7	4	0.2565	ND	0.2405	ND	0.2165	ND
50.0	Silver	149	41	72%	0.0094	175	25	13.1	0.0099	ND	2.09	0.0094	ND
Nutrient	Sodium	149	1	99%	0.0215	2930	527	757	769	521	741	305.5	
	Thallium	149	95	36%	0.002005	36.9	4	0.002375	ND	0.002225	ND	0.002005	ND
2.0	Vanadium	149	5	97%	0.00277	83.9	36	51.1	53.7	48.7	56.8	61.9	
120	Zinc	149	1	99%	1.91	60500	7614	760	77.5	291	110.5	292.5	
no benchmark	Phosphate, Total (as P)	149	0	100%	10.8	5490	1440	703	731	612	602	658	

Table E-4c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-ER-2H-0.501	OU3-0-SO-ER-3M-0	OU3-0-SO-ER-3M-0.501	OU3-0-SO-ER-4D-0.501	OU3-0-SO-ER-5A-0	OU3-0-SO-ER-5A-0.501	OU3-0-SO-ER-5G-0	OU3-0-SO-ER-5G-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0	0.501	0.501	0	0.501	0	0.501
Benchmark for Dups ave	Operable Unit Sample date	OU3 8/6/2015	OU3 8/6/2015	OU3 8/6/2015	OU3 8/6/2015	OU3 8/6/2015	OU3 8/6/2015	OU3 8/6/2015	OU3 9/10/2015
Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	29600	4290	27300	33700	32800	33300	20100	38700
5	Antimony	0.1785	ND	99.7	101	151	107	4	106
18	Arsenic	11.4	364	142	169	130	9	69.9	58.75
330	Barium	303	350	304	315	208	273	164	348
10	Beryllium	0.00292	ND	0.00292	ND	0.002715	ND	0.002435	ND
32	Cadmium	2.62	12	18.8	14	11.7	1	23.8	5.75
Nutrient	Calcium	6530	62300	8430	6220	6880	4980	18100	6810
0.40	Chromium	33	1.195	ND	29.8	43.5	44.3	36	27.5
13	Cobalt	13.4	26.7	9.18	9.79	9.5	12	6.1	12.25
70	Copper	35.6	67	82.1	331	245	26	251	105.35
200	Iron	24100	24600	23500	27000	24000	25400	13400	27450
120	Lead	44.2	263	925	3420	2720	31	1870	967.5
Nutrient	Magnesium	5990	3020	6360	6580	6110	6590	4950	6990
220	Manganese	474	15800	1200	652	843	929	343	844
0.10	Mercury	0.0007	ND	0.325	0.34	1.71	1.83	0	ND
38	Nickel	1.07	ND	1.075	ND	20.1	17.7	21	17.9
Nutrient	Potassium	6190	1400	6070	7420	7600	6570	4250	8585
1.0	Selenium	0.2675	ND	0.2675	ND	0.249	ND	0.223	ND
50.0	Silver	0.011	ND	3.26	3.34	24.1	20.8	0	ND
Nutrient	Sodium	438	596	534	510	402	440	502	893
1.0	Thallium	0.002475	ND	7.3	0.002675	ND	4.64	0	ND
2.0	Vanadium	44	4.35	36.2	49.8	52.2	50	33.3	53.45
120	Zinc	273	10300	1980	2550	2440	113	1610	626.5
no benchmark	Phosphate, Total (as P)	600	1520	807	1100	750	376	734	687

Table E-4c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-ER-5K-0	OU3-0-SO-ER-5K-0.501	OU3-0-SO-ER-6H-0.501	OU3-0-SO-ER-7J-0	OU3-0-SO-ER-7J-0.501	OU3-0-SO-ER-7O-0.501	OU3-0-SO-FT-1B-0	OU3-0-SO-FT-1B-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0.501	0	0.501	0.501	0	0.501
	Operable Unit Sample date	OU3 9/10/2015	OU3 9/10/2015	OU3 9/10/2015	OU3 9/10/2015	OU3 9/10/2015	OU3 9/10/2015	OU3 9/28/2015	OU3 9/28/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	35600	31300	36400	4110	36900	30300	30200	26300
5	Antimony	124	282	0.164	13.4	7.13	13.1	53	4.38
18	Arsenic	109	275	9.18	23.3	13.4	26.7	47.5	15.8
330	Barium	193	390	339	147	365	387	244	205
10	Beryllium	0.002515	ND	0.002555	ND	0.002685	ND	0.00326	ND
32	Cadmium	15	30.1	1.59	1.66	2.2	4.05	17.5	1.86
Nutrient	Calcium	12400	10800	6530	176000	8520	9090	11100	6450
0.40	Chromium	43.1	45.4	34.8	1.33	ND	34.6	36.6	37.9
13	Cobalt	7.62	10.9	9.49	6.07	8.89	7.37	11.8	9.21
70	Copper	226	545	33.6	27.8	36.8	38.1	131	32.4
200	Iron	26300	24500	24800	10600	25800	21000	26400	18700
120	Lead	2760	6920	54.8	128	136	185	907	58
Nutrient	Magnesium	9370	8060	6900	3480	7560	6630	7540	5470
220	Manganese	1650	1540	845	5940	402	308	1480	1230
0.10	Mercury	3.19	4.06	0.0648	0.139	0.0526	0.27	14.9	3.08
38	Nickel	20.5	0.94	ND	0.985	ND	1.195	19.4	1.16
Nutrient	Potassium	8180	7320	8230	1430	8410	6560	6880	6020
1.0	Selenium	0.2305	ND	0.234	ND	0.246	ND	0.2985	ND
50.0	Silver	26.8	48.8	0.0101	ND	0.01225	ND	0.00965	ND
Nutrient	Sodium	555	799	853	420	788	775	1350	697
1.0	Thallium	7.01	7.49	0.00228	ND	0.002765	ND	0.00217	ND
2.0	Vanadium	51.5	52	50.8	ND	5.69	46.7	44.3	55.1
120	Zinc	6290	5370	114	271	162	484	1430	185
no benchmark	Phosphate, Total (as P)	982	1250	880	428	630	583	1710	1320

Table E-4c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-FT-1C-0	OU3-0-SO-FT-1C-0.501	OU3-0-SO-FT-2B-0	OU3-0-SO-FT-2B-0.501	OU3-0-SO-FT-2C-0	OU3-0-SO-FT-2C-0.501	OU3-0-SO-FT-3B-0	OU3-0-SO-FT-3B-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0	0.501
				Dups ave					
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	9/25/2015	9/25/2015	9/28/2015	9/28/2015	9/25/2015	9/25/2015	10/5/2015	10/5/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	13300	4600	22100	32050	5620	4890	21700	27100
5	Antimony	373	358	62.3	1.99	244	379	924	7
18	Arsenic	371	399	41	13.6	231	340	372	16
330	Barium	136	53	252	211	61.5	86	211	219
10	Beryllium	0.0023	ND	0.002525	ND	0.00306	ND	0.002665	ND
32	Cadmium	161	198	13.7	1.775	151	149	77.2	95
Nutrient	Calcium	54300	63600	9950	9725	81200	70700	8740	9130
0.40	Chromium	34.2	28.9	32.3	44.6	31.7	28.7	26.1	32
13	Cobalt	9.01	6.92	8.39	7.395	15.8	10.1	12	10
70	Copper	493	578	124	30.95	430	854	1230	46
200	Iron	35600	23100	22500	21550	63100	25900	20900	21400
120	Lead	9440	10100	1230	80.35	8030	8810	12200	150
Nutrient	Magnesium	17600	18300	5260	7880	23400	18100	4660	7240
220	Manganese	3130	2380	862	350.5	2390	2610	3000	1080
0.10	Mercury	6.94	7.74	6.49	0.2295	1.76	4.14	167	2
38	Nickel	0.845	ND	0.945	ND	1.125	ND	0.9775	ND
Nutrient	Potassium	3720	2050	6180	7605	2550	1750	3690	6390
1.0	Selenium	8.76	7.9	0.28	ND	0.244	14.3	9.25	0.284
50.0	Silver	77.2	44.1	7.61	0.010025	ND	31.8	52.1	75.7
Nutrient	Sodium	234	165	448	671.5	193	141	655	383
1.0	Thallium	5.42	7.76	0.002595	ND	0.0022625	4.58	0.002195	ND
2.0	Vanadium	16.8	10.3	39.6	44.5	1.62	6.68	37.9	45
120	Zinc	30100	24800	1580	199	25200	29900	11600	3090
no benchmark	Phosphate, Total (as P)	1770	1870	1040	1011	2050	1630	1530	899

Table E-4c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-FT-3C-0	OU3-0-SO-FT-3C-0.501	OU3-0-SO-FT-3D-0	OU3-0-SO-FT-3D-0.501	OU3-0-SO-FT-4A-0	OU3-0-SO-FT-4A-0.501	OU3-0-SO-FT-4B-0	OU3-0-SO-FT-4B-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0	0.501
	Operable Unit Sample date	OU3 9/25/2015	OU3 9/25/2015	OU3 9/25/2015	OU3 9/25/2015	OU3 9/28/2015	OU3 9/28/2015	OU3 9/25/2015	OU3 9/25/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	4690	4020	38700	32200	15300	31400	9140	13600
5	Antimony	253	470	190	56	48.9	16.4	355	272.5
18	Arsenic	207	378	67.1	28	94.4	41.9	431	252.5
330	Barium	83.5	45.3	417	373	411	294	633	799.5
10	Beryllium	0.002385	ND	0.002665	ND	0.00263	0	ND	0.004165
32	Cadmium	135	93.6	47.6	9	11.5	3.06	34	61.15
Nutrient	Calcium	81200	42200	7700	6990	27500	12500	41600	84550
0.40	Chromium	59.3	30.4	41.1	36	24.5	38.1	42.7	51.5
13	Cobalt	11	2.58	14.5	9	16.8	8.57	7.13	6.08
70	Copper	350	837	256	133	118	48.2	408	377
200	Iron	46700	13200	26800	21700	26400	28400	42700	33050
120	Lead	5050	9940	1420	805	1160	277	7940	6445
Nutrient	Magnesium	20800	11100	7110	6420	6480	8020	14600	35250
220	Manganese	2150	1980	286	148	1790	228	1850	3715
0.10	Mercury	2.34	18.2	40.1	4	2.74	0.563	4.82	9.15
38	Nickel	0.875	ND	0.855	ND	21.2	1	ND	1.26
Nutrient	Potassium	2270	1270	8550	7660	3440	7250	3230	5320
1.0	Selenium	10.9	0.244	ND	0.241	ND	0	ND	22.9
50.0	Silver	28.3	59.5	10.8	6	7.05	0.0157	ND	46
Nutrient	Sodium	137	150	915	825	2930	1110	265	405.5
1.0	Thallium	3.56	5.38	0.002235	ND	0	ND	0.003535	ND
2.0	Vanadium	3.41	8.67	62.3	50	24.1	46.6	12.3	20.3
120	Zinc	21900	23500	1970	34	ND	1540	329	4900
no benchmark	Phosphate, Total (as P)	1770	1400	1030	1130	1300	1420	1680	1520

Table E-4c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-FT-4C-0	OU3-0-SO-FT-4C-0.501	OU3-0-SO-FT-5C-0	OU3-0-SO-FT-5C-0.501	OU3-0-SO-FT-6B-0	OU3-0-SO-FT-6B-0.501	OU3-0-SO-FT-6D-0	OU3-0-SO-FT-6D-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0	0.501
	Operable Unit Sample date	OU3 9/25/2015	OU3 9/25/2015	OU3 9/25/2015	OU3 9/25/2015	OU3 9/24/2015	OU3 9/24/2015	OU3 9/25/2015	OU3 9/25/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	4640	4050	5640	4920	52200	12600	23900	29100
5	Antimony	183	402	373	483	152	205	102	8.31
18	Arsenic	155	1020	463	424	129	203	34.2	25.6
330	Barium	80.2	151	115	144	347	182	440	401
10	Beryllium	0.00258	ND	0.0024	ND	0.002575	ND	0.002735	ND
32	Cadmium	48.8	111	120	133	89	62.8	18.3	13.6
Nutrient	Calcium	96700	66200	53200	32100	14300	17000	11200	9490
0.40	Chromium	32.3	28.5	32	30.4	74	37.3	50.8	35.1
13	Cobalt	6.34	2.64	15	10.4	10	11.3	8.1	9.99
70	Copper	263	947	838	930	589	318	224	41.7
200	Iron	18900	21400	60100	37200	33700	30800	18400	19600
120	Lead	4390	11200	9750	10900	6070	5430	2580	78.4
Nutrient	Magnesium	24400	19200	16300	12500	12700	7430	7850	7330
220	Manganese	2440	2690	2380	1710	796	1410	798	1220
0.10	Mercury	2.02	6.11	8.57	20.3	16	10.6	2.47	0.889
38	Nickel	0.89	ND	0.87	ND	0.945	ND	1.005	ND
Nutrient	Potassium	2300	1500	2390	2310	10100	2840	6430	7390
1.0	Selenium	0.2365	ND	0.22	ND	21.8	17.4	9.63	0.401
50.0	Silver	36.5	63	55.8	65.5	46	25.3	14.3	0.0148
Nutrient	Sodium	164	152	235	204	558	342	659	1010
1.0	Thallium	0.00219	ND	36.9	7.76	6	0.00232	ND	0.003715
2.0	Vanadium	7.72	8.15	0.07	ND	4.02	84	25.8	42.7
120	Zinc	12800	25400	22300	23300	10000	9690	2780	1010
no benchmark	Phosphate, Total (as P)	1610	1050	1690	1740	1410	1690	1530	609

Table E-4c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MR1-0.501	OU3-0-SO-MR4-0.501	OU3-0-SO-MRL-15D-0	OU3-0-SO-MRL-15D-0.501	OU3-0-SO-MRL-15E-0	OU3-0-SO-MRL-15E-0.501	OU3-0-SO-MRL-16D-0	OU3-0-SO-MRL-16D-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0.501	0	0.501	0	0.501	0	0.501
	Operable Unit Sample date	OU3 3/2/2015	OU3 3/2/2015	OU3 9/29/2015	OU3 9/29/2015	OU3 9/29/2015	OU3 9/29/2015	OU3 9/30/2015	OU3 9/30/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	27100	22400	34600	32000	27100	33100	40200	21900
5	Antimony	11.4	0.1845	ND	4.47	5.37	1460	20.1	4.27
18	Arsenic	30.6		10.8	16.1	17.5	1250	27.2	22.4
330	Barium	280		207	288	281	206	248	275
10	Beryllium	0.003075	ND	0.003025	ND	0.002635	ND	0.002765	ND
32	Cadmium	3.38		1.26	1.51	1.52	99	24	1.96
Nutrient	Calcium	6370		4310	7520	7180	54000	11200	5290
0.40	Chromium	34.6	34.6	41.5	38.4	143	40	48.3	59.6
13	Cobalt	12.6		11.9	10.9	10.6	3.31	14.4	17.6
70	Copper	74.8		22	34	34.5	1920	51.6	36.8
200	Iron	25800	23100	25800	23800	23200	23300	29100	33100
120	Lead	226		35.3	113	116	33000	334	191
Nutrient	Magnesium	7520		5880	7080	7140	19900	9540	6510
220	Manganese	1120	945	1060	1230	2280	1890	1310	1360
0.10	Mercury	0.193	0.243	0.304	0.213	33	0.455	0.269	0.202
38	Nickel	1.13	ND	1.11	ND	19.9	21.3	1.51	ND
Nutrient	Potassium	7280		4940	9380	8110	9710	7770	9490
1.0	Selenium	0.2815	ND	0.277	ND	0.2415	ND	0.2535	ND
50.0	Silver	2.72		0.0114	ND	0.0099	ND	0.0104	ND
Nutrient	Sodium	330		189	315	299	390	529	266
1.0	Thallium	0.003265	ND	0.003205	ND	0.002235	ND	0.002345	ND
2.0	Vanadium	60.5	63.9	63.6	54	67.9	43	63.4	27.7
120	Zinc	782	1140	192	186	22900	1970	336	6790
no benchmark	Phosphate, Total (as P)	1370	1630	1320	1310	4350	799	746	1310

Table E-4c. (cont.)

DRAFT

	Sample ID	OU3-9-SO-MRL-16D-0.501	OU3-0-SO-MRL-16F-0	OU3-0-SO-MRL-16F-0.501	OU3-0-SO-MRL-16H-0	OU3-0-SO-MRL-16H-0.501	OU3-0-SO-MRL-18F-0	OU3-0-SO-MRU-10C-0
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0	0.501	0	0.501	0	0
	Operable Unit Sample date	OU3 9/30/2015	OU3 9/28/2015	OU3 9/28/2015	OU3 9/28/2015	OU3 9/28/2015	OU3 9/29/2015	OU3 10/1/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	23000	19400	28500	35800	37700	33700	15000
5	Antimony	177	1800	1570	4.33	0.157	ND	188
18	Arsenic	156	1130	517	14.4	15.5	75.5	171
330	Barium	238	215	248	269	329	292	303
10	Beryllium	0	ND	0.00291	ND	0.002655	ND	0.00381
32	Cadmium	49	77.6	35	2.26	1.34	91.4	50.5
Nutrient	Calcium	19400	10600	4110	11900	7010	10500	12600
0.40	Chromium	35	25.3	25	38.3	36.7	45.6	18.6
13	Cobalt	16	9.41	8	9.26	14	12.4	6.03
70	Copper	292	3140	2560	38.9	30.8	451	561
200	Iron	38400	27100	16700	25200	27700	26300	19600
120	Lead	4090	40700	18500	88.2	30.3	1790	7060
Nutrient	Magnesium	10400	3590	3920	6510	6810	7070	3150
220	Manganese	1820	2740	1020	541	1660	763	1360
0.10	Mercury	38	2950	84	0.124	0.000755	ND	58.7
38	Nickel	18	1.07	ND	1	19.6	22.3	1.4
Nutrient	Potassium	5800	3230	3310	8580	8260	7040	2350
1.0	Selenium	8	12.3	0	0.243	0.235	ND	0.349
50.0	Silver	20	18.5	147	0.01	0.00965	ND	17
Nutrient	Sodium	257	1120	2130	427	358	593	559
1.0	Thallium	0	ND	0.00247	ND	0.00218	ND	0.003235
2.0	Vanadium	33	39.2	31	54.3	54.5	54	26.5
120	Zinc	8410	26800	14900	286	145	3280	12000
no benchmark	Phosphate, Total (as P)	1300	2240	1690	1430	1440	1340	1030

Table E-4c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRU-10C-0.501	OU3-0-SO-MRU-11C-0	OU3-0-SO-MRU-11C-0.501	OU3-0-SO-MRU-12C-0	OU3-0-SO-MRU-12C-0.501	OU3-0-SO-MRU-13C-0	OU3-0-SO-MRU-13C-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0	0.501	0	0.501	0	0.501
	Operable Unit Sample date	OU3 10/1/2015	OU3 10/1/2015	OU3 10/1/2015	OU3 10/1/2015	OU3 10/1/2015	OU3 10/1/2015	OU3 10/1/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	3760	2.08	6710	7270	6160	41100	5190
5	Antimony	1100	663	203	374	413	290	355
18	Arsenic	770	793	216	568	393	182	724
330	Barium	241	654	131	68.4	156	375	220
10	Beryllium	0.002585	ND	0.003065	ND	0.00242	ND	0.00266
32	Cadmium	127	148	69.1	70.4	92.9	44.6	65.9
Nutrient	Calcium	6690	5.43	60400	42600	63600	14400	14500
0.40	Chromium	22.7	98.6	41.3	29.8	47.7	76.3	24.1
13	Cobalt	9.04	3.93	15.5	4.11	2.81	9.91	31.3
70	Copper	2080	854	365	541	719	909	685
200	Iron	26300	4.09	77300	15300	14400	28700	97500
120	Lead	22600	14000	7680	8950	9670	8930	11200
Nutrient	Magnesium	1550	2.51	20200	10400	17400	13700	7230
220	Manganese	3620	2790	2120	1950	3370	1510	1040
0.10	Mercury	50.4	16.4	5.49	5.28	6.92	36.4	12
38	Nickel	0.95	ND	1.125	ND	0.89	ND	25.5
Nutrient	Potassium	491	0.884	3350	2120	2250	7240	1600
1.0	Selenium	8.35	18.9	19.9	8.55	0.2395	10.4	28.7
50.0	Silver	99.2	85.6	28.2	45.2	51.3	77.6	36.1
Nutrient	Sodium	457	0.0215	190	276	111	671	200
1.0	Thallium	0.002195	ND	21.6	8.51	7.64	8.31	0.0025
2.0	Vanadium	7	0.00277	0.093	ND	10.8	72.4	0.085
120	Zinc	60500	15300	13300	19000	25900	9500	14200
no benchmark	Phosphate, Total (as P)	726	3090	3530	1530	1640	1470	1780

Table E-4c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRU-1C-0	OU3-0-SO-MRU-1C-0.501	OU3-0-SO-MRU-1D-0	OU3-0-SO-MRU-1D-0.501	OU3-0-SO-MRU-2B-0	OU3-0-SO-MRU-2B-0.501	OU3-0-SO-MRU-2C-0	OU3-0-SO-MRU-2C-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0	0.501
	Dups ave								
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	11/10/2014	11/10/2014	11/12/2014	11/12/2014	11/10/2014	11/10/2014	11/10/2014	11/10/2014
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	17160	18300	21100	23600	20900	31400	26800	20400
5	Antimony	165.5	187	24.3	24.6	100	0.2165	40.1	345
18	Arsenic	192	222	24.1	31.2	80	11.3	51.5	297
330	Barium	291	472	186	186	225	277	220	216
10	Beryllium	0.0030475	ND	0.003625	ND	0.00298	ND	0.003605	ND
32	Cadmium	59.1		31.7		7.1		5.1	
Nutrient	Calcium	18450	18000	15000	66500	12100	9420	14400	13700
0.40	Chromium	47.15	48.6	50.6	31.4	62.7	93.5	43.8	45.2
13	Cobalt	14.9		9.08		11		9.02	
70	Copper	334.5	330	74.7	74.4	160		24.1	
200	Iron	35650	34300	20400	20900	18000	23300	21200	27300
120	Lead	4005	3760	660	401	2460		24.7	
Nutrient	Magnesium	9690	9050	8400	9220	4120	5210	7440	6720
220	Manganese	2570	1330	1140	3390	925	925	1490	1490
0.10	Mercury	2.7535		0.888		1.53		1.11	
38	Nickel	13.2725		1.33		ND	ND	1.165	
Nutrient	Potassium	5825	6490	7640	8150	5640	7780	6010	5300
1.0	Selenium	0.27925	ND	0.332	ND	0.273	ND	0.3305	ND
50.0	Silver	30.55		34.2		4.59		3.08	
Nutrient	Sodium	375		264		705		1080	
1.0	Thallium	2.211325		0.00308		0.00253		0.00306	
2.0	Vanadium	44.15		33.2		48.9		52.9	
120	Zinc	5635		5170		1230		901	
no benchmark	Phosphate, Total (as P)	1990	4450	1720	1300	3760	1930	1800	5490

Table E-4c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRU-2D-0	OU3-0-SO-MRU-2D-0.501	OU3-0-SO-MRU-3C-0	OU3-0-SO-MRU-3C-0.501	OU3-0-SO-MRU-3D-0	OU3-0-SO-MRU-3D-0.501	OU3-0-SO-MRU-4C-0	OU3-0-SO-MRU-4C-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0	0.501
	Operable Unit Sample date	OU3 11/12/2014	OU3 11/12/2014	OU3 11/10/2014	OU3 11/10/2014	OU3 11/12/2014	OU3 11/12/2014	OU3 11/10/2014	OU3 11/11/2014
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	29000	22800	31600	28500	19600	29900	17000	20000
5	Antimony	0.1675	ND	0.227	ND	24.7	171	0.19	ND
18	Arsenic	7.23		11.1		37.5	192		
330	Barium	218		154		328	222		
10	Beryllium	0.002745	ND	0.003715	ND	0.003015	ND	0.00347	ND
32	Cadmium	2.4		0.0105		9.5	26.9	3.3	
Nutrient	Calcium	8660		83700		6690	8560	14200	
0.40	Chromium	37.1		28.6		36	45.6	66.8	39.5
13	Cobalt	15.9		9.21		12.3	9.79	28.8	13.7
70	Copper	31.4		0.96	ND	111	300	58.9	35.5
200	Iron	30300		20400		28100	26300	22700	31300
120	Lead	42.6		42.3		868	4230	68.2	220
Nutrient	Magnesium	6620		13900		6920	8210	8710	10900
220	Manganese	776		3460		879	995	576	1010
0.10	Mercury	0.00142	ND	0.081		1.01	0.688	0.0804	0.489
38	Nickel	1.01	ND	1.365	ND	1.105	ND	1.275	ND
Nutrient	Potassium	5430		7960		7930	9970	4380	8540
1.0	Selenium	0.2515	ND	0.3405	ND	0.276	ND	0.318	ND
50.0	Silver	0.01035	ND	0.014	ND	3.88	20.2	0.0117	ND
Nutrient	Sodium	2190		1210		359	462	2080	2740
1.0	Thallium	0.00233	ND	0.003155	ND	0.00256	ND	0.002945	ND
2.0	Vanadium	83.7		47.8		62.3	51.6	56.4	69.4
120	Zinc	166		148		1250	4620	260	540
no benchmark	Phosphate, Total (as P)	927		1510		1260	2430	847	1140
									1410
									1330

Table E-4c. (cont.)

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	Sample ID	OU3-0-SO-MRU-4D-0	OU3-0-SO-MRU-4D-0.501	OU3-0-SO-MRU-5C-0	OU3-0-SO-MRU-5C-0.501	OU3-0-SO-MRU-5D-0	OU3-0-SO-MRU-5D-0.501	OU3-0-SO-MRU-6C-0	OU3-0-SO-MRU-6C-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0	0.501
	Dups ave								
Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
Sample date	11/12/2014	11/12/2014	11/11/2014	11/11/2014	11/12/2014	11/12/2014	11/11/2014	11/11/2014	11/11/2014
Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	28450	28900	26200	25100	26300	26800	30300	31100
5	Antimony	8.1	49	61.4	40.1	13.2	16.5	39.7	13.6
18	Arsenic	15.35	55.3	151	45.7	19.2	27.6	41.1	20.1
330	Barium	257.5	273	318	165	258	162	191	260
10	Beryllium	0.003135	ND	0.003705	ND	0.003305	ND	0.002925	ND
32	Cadmium	2.665	15.7	65.1	7.78	4.88	3.87	32.3	6.38
Nutrient	Calcium	5525	13400	33700	56800	5600	14600	24500	14500
0.40	Chromium	35.45	44.3	47.6	105	38.4	39.5	60.2	85.9
13	Cobalt	11	11	21.9	6.78	10.9	9.23	7.95	7.06
70	Copper	35.15	107	216	88.5	46	51.2	144	38.5
200	Iron	25750	24900	27200	18300	22700	22700	21600	22800
120	Lead	185	1260	2040	928	388	729	1120	226
Nutrient	Magnesium	6270	7470	10100	27200	7220	7600	8770	5310
220	Manganese	913	1470	15600	1100	1170	848	1360	409
0.10	Mercury	0.295	3.92	3.88	3.67	0.615	0.521	1.48	0.55
38	Nickel	11.4425	1.36	ND	40.4	1.31	ND	29.8	1.51
Nutrient	Potassium	8775	7640	5640	6720	8920	8240	6520	7570
1.0	Selenium	0.28725	ND	0.3395	ND	0.303	ND	0.2925	ND
50.0	Silver	0.011825	ND	6.47	16.6	3.93	1.91	3.06	9.2
Nutrient	Sodium	385.5	478	493	665	277	184	912	496
1.0	Thallium	0.0026625	ND	0.003145	ND	0.002805	ND	0.002485	ND
2.0	Vanadium	64.35	64.6	46.1	52	61.2	59	51.5	57.2
120	Zinc	355.5	2670	12500	1510	708	768	5060	1300
no benchmark	Phosphate, Total (as P)	1255	1810	2010	3930	1640	2120	3620	5340

Table E-4c. (cont.)

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	Sample ID	OU3-0-SO-MRU-7C-0	OU3-0-SO-MRU-7C-0.501	OU3-0-SO-MRU-7D-0	OU3-0-SO-MRU-7D-0.501	OU3-0-SO-MRU-8C-0	OU3-0-SO-MRU-8C-0.501	OU3-0-SO-NR-10I-0.501	OU3-0-SO-NR-11J-0
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0.501	0
	Operable Unit Sample date	OU3 9/30/2015	OU3 9/30/2015	OU3 10/1/2015	Dups ave OU3 10/1/2015	OU3 10/1/2015	OU3 10/1/2015	Dups ave OU3 9/21/2015	OU3 9/21/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	23200	16900	46700	41050	26100	34900	30300	26700
5	Antimony	294	40.7	6.75	2.13075	30	6.26	8.16	2290
18	Arsenic	246	46.4	15.7	11.5	55.2	32.2	17.75	846
330	Barium	245	183	369	299	364	376	352	320
10	Beryllium	0.00233	ND	0.00253	ND	0.0026825	ND	0.00266	ND
32	Cadmium	37.6	6.18	2.18	1.525	5.83	1.94	9.285	49.7
Nutrient	Calcium	19300	39200	15100	5615	21900	14600	8125	2580
0.40	Chromium	55.7	88.9	47	46.7	66.6	67.5	40	14.8
13	Cobalt	11.5	6	14.3	11.65	9.02	10.9	10.18	5.11
70	Copper	505	75.2	26.3	18.6	93.3	38.8	32.35	2200
200	Iron	34800	20100	32200	30600	26000	27600	24700	11100
120	Lead	7060	830	184	93.9	837	58.5	25.6	22200
Nutrient	Magnesium	8870	27900	16800	11900	5050	6600	8595	1380
220	Manganese	2200	960	1590	801.5	1270	1440	1053.5	874
0.10	Mercury	15.9	1.94	0.344	0.2845	2.64	0.531	0.2165	676
38	Nickel	20.6	19.4	26.1	24.9	20.6	24.2	20.25	25.2
Nutrient	Potassium	5080	4520	16800	14150	6990	9330	7770	1800
1.0	Selenium	8.14	0.232	ND	0.2305	ND	0.24575	ND	0.2455
50.0	Silver	47.2	6.64	0.00945	ND	0.0101	ND	0.01	ND
Nutrient	Sodium	276	539	484	468	612	473	883.5	2600
1.0	Thallium	3.56	0.00215	ND	0.002135	ND	0.0022775	ND	0.002255
2.0	Vanadium	67.1	59.3	76.1	67.7	53	59.7	40.1	30.7
120	Zinc	8100	1130	339	218	967	191	941.5	14300
no benchmark	Phosphate, Total (as P)	1740	5670	1000	894	5540	4530	798	909

Table E-4c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-NR-11J-0.501	OU3-0-SO-NR-13L-0	OU3-0-SO-NR-13L-0.501	OU3-0-SO-NR-13M-0	OU3-0-SO-NR-13M-0.501	OU3-0-SO-NR-14M-0	OU3-0-SO-NR-14M-0.501	OU3-0-SO-NR-14P-0
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0	0.501	0	0.501	0	0.501	0
	Operable Unit Sample date	OU3 9/21/2015	OU3 9/18/2015	OU3 9/18/2015	OU3 9/18/2015	OU3 9/18/2015	OU3 9/18/2015	OU3 9/18/2015	OU3 9/21/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	32400	33300	42600	7510	29700	7060	20700	26400
5	Antimony	5.6	12	11.9	600	0.1975	ND	465	1170
18	Arsenic	6.88	19	35.7	568	9.93	ND	384	702
330	Barium	317	393	436	149	227	192	256	175
10	Beryllium	0.00273	ND	0.003315	ND	0.003375	ND	0.00276	ND
32	Cadmium	1.5	4.51	6.04	118	3.88	ND	51.8	106
Nutrient	Calcium	8510	10800	10900	38400	6900	26900	9840	7930
0.40	Chromium	37.7	43.3	55.6	72.8	48.6	40.5	42.2	29.1
13	Cobalt	6.53	7.55	17.3	5.63	7.43	5.99	7.57	7.2
70	Copper	26.1	44.2	45.1	950	0.835	ND	766	1750
200	Iron	24500	25700	34000	21200	15600	22100	23100	19100
120	Lead	24.9	141	138	15800	32.3	7920	25300	593
Nutrient	Magnesium	8480	7940	9410	10100	6640	8100	5070	5790
220	Manganese	125	252	767	2750	155	1560	2100	448
0.10	Mercury	0.215	0.274	0.145	17.3	0.00082	ND	26.9	132
38	Nickel	18.8	23.1	26	1.015	ND	1.185	ND	1.31
Nutrient	Potassium	8150	7210	7840	2310	4840	1850	4310	7460
1.0	Selenium	0.25	ND	0.3035	ND	0.309	ND	0.296	ND
50.0	Silver	0.01025	ND	0.01245	ND	0.0127	ND	0.01215	ND
Nutrient	Sodium	926	934	995	301	657	329	1130	586
1.0	Thallium	0.002315	ND	0.00281	ND	0.002865	ND	0.002745	ND
2.0	Vanadium	45.8	50	52.3	14.7	37.7	13.2	41.6	37.6
120	Zinc	106	788	572	22100	1790	12800	26400	4290
no benchmark	Phosphate, Total (as P)	871	859	836	1910	665	1740	925	650

Table E-4c. (cont.)

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	Sample ID	OU3-0-SO-NR-14P-0.501	OU3-0-SO-NR-15M-0	OU3-0-SO-NR-15M-0.501	OU3-0-SO-NR-15P-0	OU3-0-SO-NR-15PI-0.501	OU3-0-SO-NR-2E-0.501	OU3-0-SO-NR-3F-0	OU3-0-SO-NR-3F-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0	0.501	0	0.501	0.501	0	0.501
	Operable Unit Sample date	OU3 9/21/2015	OU3 9/17/2015	OU3 9/17/2015	OU3 9/21/2015	OU3 9/21/2015	OU3 9/22/2015	OU3 9/22/2015	OU3 9/22/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	31300	9180	12800	5780	8360	33900	32900	36700
5	Antimony	0.1495	ND	805	622	343	430	0.1765	ND
18	Arsenic	7.78	701	1330	307	405	9.19	96	11
330	Barium	197	174	230	160	223	374	282	358
10	Beryllium	0.002445	ND	0.00236	ND	0.003185	ND	0.002705	ND
32	Cadmium	0.948	100	119	40.3	67.2	2.71	31	1.27
Nutrient	Calcium	5300	33000	34600	27000	37800	6080	10100	7550
0.40	Chromium	30.2	34.5	38.8	23.2	43.5	39.1	45	52.1
13	Cobalt	8.02	6.38	8.92	7.99	7.04	12.3	8	7.23
70	Copper	20.2	1210	963	476	676	30.9	205	25.8
200	Iron	21700	20300	27600	32900	31100	23400	25800	24000
120	Lead	15.3	16300	12600	7000	8960	33.2	3060	33.2
Nutrient	Magnesium	6240	10300	12100	8770	14300	5760	7880	8470
220	Manganese	301	2630	2230	1450	2590	759	1070	438
0.10	Mercury	0.000765	ND	27.6	18.6	8.88	8.86	0.821	17
38	Nickel	0.895	ND	0.865	ND	1.17	ND	0.995	ND
Nutrient	Potassium	8060	2690	3360	1710	3120	8390	8290	7870
1.0	Selenium	0.224	ND	10.2	13.1	13.4	13.2	0.2645	ND
50.0	Silver	0.0092	ND	96	81.1	29.6	57	0.01085	ND
Nutrient	Sodium	650	382	373	213	208	622	1190	823
1.0	Thallium	0.002075	ND	5.13	6.37	3.75	7.07	0.00245	ND
2.0	Vanadium	41.8	20.4	26	5.91	13.6	54.9	47	45.5
120	Zinc	81.4	20900	14900	10100	10900	1190	5240	183
no benchmark	Phosphate, Total (as P)	578	1560	2220	1310	1530	832	942	635

Table E-4c. (cont.)

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	Sample ID	OU3-0-SO-NR-4H-0.501	OU3-0-SO-NR-7I-0	OU3-0-SO-NR-7I-0.501	OU3-0-SO-NR-8I-0.501	OU3-0-SO-NR-9G-0.501	OU3-0-SO-NR-9J-0	OU3-0-SO-WR-1B-0	OU3-0-SO-WR-1B-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0	0.501	0.501	0.501 Dups ave	0	0	0.501
	Operable Unit Sample date	OU3 9/22/2015	OU3 9/21/2015	OU3 9/21/2015	OU3 9/21/2015	OU3 9/22/2015	OU3 9/21/2015	OU3 8/4/2015	OU3 8/4/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	31800	33300	33100	10700	18750	6170	4670	3540
5	Antimony	33.3	26.6	0.169	ND	508	335.5	271	172
18	Arsenic	23.9	26.6	8.83	398	333.5	297	189	370
330	Barium	412	365	383	139	393.5	259	155	248
10	Beryllium	0.003665	ND	0.00285	ND	0.003135	ND	0.00296	ND
32	Cadmium	15.6	9.75	2.16	84.6	38.35	76.4	72.6	72.7
Nutrient	Calcium	11600	10500	9410	19600	16900	43900	107000	39900
0.40	Chromium	40.2	45.3	47.1	29.9	37.35	30.1	16.2	21
13	Cobalt	7.09	10	8.93	3.17	6.625	52.4	5.56	6.77
70	Copper	46	70.2	29.4	751	605	390	227	474
200	Iron	22600	25200	24800	14500	20900	122000	22300	41700
120	Lead	97.9	597	29.5	13500	7565	6630	3470	7650
Nutrient	Magnesium	7480	9130	9320	6030	8300	8600	10700	14000
220	Manganese	204	380	354	1480	869	1600	1710	1870
0.10	Mercury	0.989	3.11	0.28	80	5.135	11.1	2.24	7.07
38	Nickel	1.345	ND	21.5	22	1.15	ND	1.09	ND
Nutrient	Potassium	7580	8010	7670	1980	4505	1530	1510	1360
1.0	Selenium	0.3355	ND	0.261	ND	0.287	ND	30.9	8.9
50.0	Silver	0.0138	ND	2.62	0.0104	ND	63.7	55.35	39
Nutrient	Sodium	1700	1380	987	386	1813.5	258	219	132
1.0	Thallium	0.00311	ND	0.00242	ND	0.00266	ND	6.0512725	48.1
2.0	Vanadium	64.4	45.8	42.6	21.7	36.25	0.085	6.41	1.36
120	Zinc	769	975	178	18100	8135	12400	15200	12800
no benchmark	Phosphate, Total (as P)	762	1970	930	1580	1570	2700	1520	531

Table E-4c. (cont.)

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	Sample ID	OU3-0-SO-WR-1F-0	OU3-0-SO-WR-1F-0.501	OU3-0-SO-WR-2B-0	OU3-0-SO-WR-2B-0.501	OU3-0-SO-WR-2F-0	OU3-0-SO-WR-2F-0.501	OU3-0-SO-WR-3B-0.501	OU3-0-SO-WR-3C-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0.501	0.501
	Operable Unit Sample date Habitat	OU3 7/31/2015 Floodplain	OU3 7/31/2015 Floodplain	OU3 8/4/2015 Floodplain	OU3 8/4/2015 Floodplain	OU3 7/31/2015 Floodplain	OU3 7/31/2015 Floodplain	OU3 8/4/2015 Floodplain	OU3 7/31/2015 Floodplain
50	Aluminum	7670	5200	6090	6560	13100	8010	3320	10100
5	Antimony	253	183	328	343	308	281	197	443
18	Arsenic	287	247	340	404	264	576	317	435
330	Barium	227	569	237	302	186	288	48	472
10	Beryllium	0.00296	ND	0.00372	ND	0.002325	ND	0.002805	ND
32	Cadmium	78.7	39	97.4	52.3	92.1	80.2	107	64.4
Nutrient	Calcium	44900	43400	50700	47400	104000	58600	57700	54700
0.40	Chromium	28.3	20.7	23.5	31.1	33.9	35.7	21	42.9
13	Cobalt	8.36	9.53	11.8	7.05	8.47	10.2	4.53	6.49
70	Copper	398	255	474	527	586	436	256	720
200	Iron	40100	46000	28800	34300	19200	50800	15700	44900
120	Lead	5550	4300	6370	8020	5750	5210	7220	7120
Nutrient	Magnesium	14100	14100	10900	15300	11400	20500	17000	18000
220	Manganese	2490	1800	2690	2280	1230	2210	2760	1960
0.10	Mercury	3.93	4.96	5.75	11.1	13.3	6.86	3.35	17.4
38	Nickel	1.085	ND	1.365	ND	20.9	1.03	ND	1.295
Nutrient	Potassium	2780	2110	1820	2490	4450	3440	1160	4310
1.0	Selenium	16	21.1	13.3	12.7	0.3045	ND	17.1	0.235
50.0	Silver	29.1	24.8	28.3	41.4	34	36.3	34	54.7
Nutrient	Sodium	181	183	388	265	5960	318	4.155	ND
1.0	Thallium	15.2	5.25	20.6	9.08	31.8	8.02	5.99	10.9
2.0	Vanadium	5.45	0.0855	ND	9.62	8.69	19.6	4.02	6.52
120	Zinc	14600	6180	34700	11400	26000	11500	22800	8230
no benchmark	Phosphate, Total (as P)	1550	1400	1460	607	971	2220	314	2260

Table E-4c. (cont.)

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	Sample ID	OU3-0-SO-WR-3E-0.501	OU3-0-SO-WR-5B-0	OU3-0-SO-WR-5B-0.501	OU3-0-SO-WR-5F-0	OU3-0-SO-WR-5F-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0	0.501	0	0.501
	Operable Unit	OU3	OU3	OU3	OU3	OU3
	Sample date	7/31/2015	8/4/2015	8/4/2015	7/31/2015	7/31/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
50	Aluminum	4670	9240	4520	4520	3590
5	Antimony	254	207	234	192	407
18	Arsenic	570	191	284	418	389
330	Barium	268	180	280	54.85	106
10	Beryllium	0	ND	0.00288	ND	0
32	Cadmium	71	123	41.3	88.85	98
Nutrient	Calcium	50500	142000	43500	49450	62900
0.40	Chromium	24	21.8	20.8	28.8	37
13	Cobalt	7	9.87	8.04	3.65	5
70	Copper	360	345	333	354.5	428
200	Iron	36600	15700	38800	16500	12200
120	Lead	4680	5040	4480	3625	3320
Nutrient	Magnesium	16300	9180	12200	17750	17700
220	Manganese	2170	1340	1570	2345	1700
0.10	Mercury	6	5.88	5.61	2.8	2
38	Nickel	1	ND	1.055	ND	0.9325
Nutrient	Potassium	1860	2580	1570	1525	1150
1.0	Selenium	12	0.2635	ND	15	0.2325
50.0	Silver	31	25.3	26.4	22	31
Nutrient	Sodium	190	1180	138	252.5	135
1.0	Thallium	7	14.5	0.00249	ND	8.98
2.0	Vanadium	1	16.8	2.49	ND	6.44
120	Zinc	14300	26500	8520	17950	6200
no benchmark	Phosphate, Total (as P)	1600	1220	363	1305	1260

Notes:

Samples were collected November 2014 to October 2015

All samples analyzed by laboratory as bulk samples.

Results reported as mg/kg

Non-detects are reported at half the detection limit

Duplicate samples have been averaged

Sampling Depth:

0 is a surface sample; collected at 0-2 inches

0.501 is taken between 6 inches and 1 foot beneath surface

Benchmarks are the lowest value of the EcoSSLs for plants and soil invertebrates, or the ORNL LOEC for plants, soil organisms, and microbes

Key:

ER = OU3 P.C. East Reach

ND = Non-Detect

FT = OU3 Floodplain Tailings Reach

NR = OU3 State Route 248 North Reach

ID = Identification

OU3 = Richardson Flat Tailings Site Operable Unit 3

mg/kg = milligrams per kilogram

SO = Soil

MRL = OU3 Middle Reach Lower

WR = OU3 P.C. West Reach

MR# = OU3 Middle Reach Boring Sample Collected during piezometer installation; See Figure 1-3 for piezometer location

Table E-4d. Screening results for OU3 Upland soil samples compared with benchmarks for effects to soil inverts and plants

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Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	Sample ID	Sample date	Operable Unit	Habitat	N	count of NDs	% detected	Minimum	Maximum	Average	OU3-0-SO-ER-10Q-0.501	OU3-0-SO-ER-11D-0	OU3-0-SO-ER-11D-0.501	OU3-0-SO-ER-11Q-0.501	OU3-0-SO-ER-11S-0
												OU3 9/11/2015 Upland	OU3 9/14/2015 Upland	OU3 9/14/2015 Upland	OU3 9/14/2015 Upland	OU3 9/11/2015 Upland
50	Aluminum	112	0	100%	3450	321000	35491	29400	29400	29400	29400	0.501	0	0.501	0.501	0
5	Antimony	112	32	71%	0.1445	267	29	94.5	94.5	94.5	94.5	0.501	0	0.501	0.501	0
18	Arsenic	112	0	100%	9.12	223	37	101	101	101	101	0.501	0	0.501	0.501	0
330	Barium	112	0	100%	167	3620	313	209	209	209	209	0.501	0	0.501	0.501	0
10	Beryllium	112	110	2%	0.00224	1.86	0	0.002555	0.002555	0.002555	0.002555	0.501	0	0.501	0.501	0
32	Cadmium	112	4	96%	0.0076	98.3	6	8.84	8.84	8.84	8.84	0.501	0	0.501	0.501	0
Nutrient	Calcium	112	0	100%	4220	57800	10028	6290	6290	6290	6290	0.501	0	0.501	0.501	0
0.40	Chromium	112	1	99%	18.3	367	49	36.8	36.8	36.8	36.8	0.501	0	0.501	0.501	0
13	Cobalt	112	1	99%	0.0765	117	12	8.16	8.16	8.16	8.16	0.501	0	0.501	0.501	0
70	Copper	112	3	97%	8.98	522	76	183	183	183	183	0.501	0	0.501	0.501	0
200	Iron	112	0	100%	14100	255000	29176	25000	25000	25000	25000	0.501	0	0.501	0.501	0
120	Lead	112	0	100%	16.5	18800	810	2010	2010	2010	2010	0.501	0	0.501	0.501	0
Nutrient	Magnesium	112	0	100%	481	61500	6922	5710	5710	5710	5710	0.501	0	0.501	0.501	0
220	Manganese	112	0	100%	88.2	12800	1074	612	612	612	612	0.501	0	0.501	0.501	0
0.10	Mercury	112	14	88%	0.000645	11.3	1	1.05	1.05	1.05	1.05	0.501	0	0.501	0.501	0
38	Nickel	112	41	63%	0.82	220	17	0.94	0.94	0.94	0.94	0.501	0	0.501	0.501	0
Nutrient	Potassium	112	0	100%	3050	75600	8149	6110	6110	6110	6110	0.501	0	0.501	0.501	0
1.0	Selenium	112	110	2%	0.205	40.2	1	0.234	0.234	0.234	0.234	0.501	0	0.501	0.501	0
50.0	Silver	112	54	52%	0.00845	76.3	5	16.4	16.4	16.4	16.4	0.501	0	0.501	0.501	0
Nutrient	Sodium	112	1	99%	4.625	3840	505	571	571	571	571	0.501	0	0.501	0.501	0
1.0	Thallium	112	108	4%	0.0019	17.1	0	0.00217	0.00217	0.00217	0.00217	0.501	0	0.501	0.501	0
2.0	Vanadium	112	2	98%	0.082	596	65	62.3	62.3	62.3	62.3	0.501	0	0.501	0.501	0
120	Zinc	112	2	98%	0.1145	15900	965	1590	1590	1590	1590	0.501	0	0.501	0.501	0
no benchmark	Phosphate, Total (as P)	112	0	100%	97.7	68400	2141	738	738	738	738	0.501	0	0.501	0.501	0

Table E-4d. (cont.)

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	Sample ID	OU3-0-SO-ER-11S-0.501	OU3-0-SO-ER-1C-0.501	OU3-0-SO-ER-1N-0.501	OU3-0-SO-ER-2A-0.501	OU3-0-SO-ER-2D-0.501	OU3-0-SO-ER-3C-0.501	OU3-0-SO-ER-3E-0.501	OU3-0-SO-ER-3H-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0.501	0.501	0.501	0.501	0.501 Dups ave	0.501	0.501
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	9/11/2015	9/14/2015	8/5/2015	9/14/2015	8/6/2015	9/14/2015	8/6/2015	8/6/2015
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	28500	34400	27000	29300	31500	32900	32200	25400
5	Antimony	0.1525	ND	51.9	6.75	86	0.1615	ND	33
18	Arsenic	10.9	60	13.3	88.3	9.86	38	19.1	43.4
330	Barium	237	245	267	277	297	274	283	209
10	Beryllium	0.00249	ND	0.00233	ND	0.00257	ND	0	ND
32	Cadmium	0.835	8.76	1.93	10.2	1.23	5	2.93	4.48
Nutrient	Calcium	4430	6500	5370	5560	42400	6020	5360	5430
0.40	Chromium	34.3	34.6	36.2	43.5	34.6	34	34.4	34
13	Cobalt	13.5	12.3	11.6	13.7	8.86	10	10.2	10.6
70	Copper	19.3	99	29.1	145	21.9	83	39.8	78.7
200	Iron	23400	33600	22400	32100	23300	28000	25300	21700
120	Lead	25	1020	75.3	1850	53.4	628	186	606
Nutrient	Magnesium	5880	6150	5910	5650	8390	6455	6290	4660
220	Manganese	1180	1220	872	1460	579	823	767	335
0.10	Mercury	0.00066	ND	0.543	0.106	1.09	0.000725	ND	0.194
38	Nickel	17	18.3	19.7	0.945	ND	18.2	18	0.94
Nutrient	Potassium	5770	6490	6470	5710	8310	6520	6350	4750
1.0	Selenium	0.2285	ND	0.2135	ND	0.231	ND	0	ND
50.0	Silver	0.0094	ND	7.85	0.0095	ND	13.5	0.00995	ND
Nutrient	Sodium	432	499	576	420	417	576	388	442
1.0	Thallium	0.002115	ND	0.00198	ND	0.002185	ND	0	ND
2.0	Vanadium	60.6	60.5	56.7	80.1	46.1	67	47.9	45.9
120	Zinc	68.2	966	185	1420	128	676	335	43.55
no benchmark	Phosphate, Total (as P)	501	498	700	584	849	525	424	997

Table E-4d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-ER-4B-0	OU3-0-SO-ER-4B-0.501	OU3-0-SO-ER-4H-0.501	OU3-0-SO-ER-4N-0.501	OU3-0-SO-ER-4Q-0	OU3-0-SO-ER-4Q-0.501	OU3-0-SO-ER-6A-0	OU3-0-SO-ER-6A-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0.501	0.501	0	0.501	0	0.501
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	9/14/2015	9/14/2015	9/10/2015	9/10/2015	8/5/2015	8/5/2015	9/14/2015	9/14/2015
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	31700	33600	35100	27300	26600	28500	30400	36500
5	Antimony	62.8	40.6	17.3	15	20.4	8.38	4.2	0.159
18	Arsenic	80.5	49.5	23	21.6	41.2		10.9	9.12
330	Barium	226	291	323	281	344		230	198
10	Beryllium	0.00259	ND	0.00261	ND	0.002415	ND	0.002435	ND
32	Cadmium	10.7	8.31	2.86	3.01	5.15	2.17	2.26	1.11
Nutrient	Calcium	7910	5890	7160	5590	6680	6430	6550	5460
0.40	Chromium	39.1	36.1	34.3	40	37.1	34.9	29.8	36.3
13	Cobalt	8.91	14.2	9.46	16.3	13	10.2	9.31	12.2
70	Copper	135	74.7	38.5	35.8	78.6	43.4	28.1	24.2
200	Iron	24300	27900	25800	28800	22800	23300	26900	32000
120	Lead	1520	738	295	199	642	214	67.5	25
Nutrient	Magnesium	6220	6300	6910	5300	5540	5810	5550	6620
220	Manganese	894	1310	717	1220	1180	706	811	957
0.10	Mercury	0.911	0.591	0.275	0.179	0.405	0.15	0.118	0.000685
38	Nickel	0.95	ND	19.3	0.925	ND	17.5	18.5	ND
Nutrient	Potassium	6890	6860	6480	5260	6460	6240	7410	8080
1.0	Selenium	0.237	ND	0.239	ND	0.2305	ND	0.223	ND
50.0	Silver	13.7	5.68	2.56	1.56	4.13	1.52	0.00845	ND
Nutrient	Sodium	419	483	808	586	432	533	508	618
1.0	Thallium	0.0022	ND	0.002215	ND	0.00214	ND	0.002065	ND
2.0	Vanadium	59.6	69.4	50.4	65.5	55.4	53	52.6	63.4
120	Zinc	1540	722	295	221	661	256	286	86.7
no benchmark	Phosphate, Total (as P)	579	536	395	693	565	904	596	554

Table E-4d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-ER-6D-0.501	OU3-0-SO-ER-6N-0.501	OU3-0-SO-ER-7P-0	OU3-0-SO-ER-7P-0.501	OU3-0-SO-ER-8A-0	OU3-0-SO-ER-8A-0501	OU3-0-SO-ER-8Q-0.501	OU3-0-SO-ER-9Q-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0.501	0	0.501	0	0501	0.501	0.501
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	9/14/2015	9/10/2015	9/10/2015	9/10/2015	9/14/2015	9/14/2015	9/10/2015	9/11/2015
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	35800	30600	30100	30700	26800	38800	30900	28150
5	Antimony	27.6	17.7	116	51	8.71	4.82	128	56
18	Arsenic	25.8	24.5	103	56.9	11.1	12.7	118	59
330	Barium	239	325	228	235	167	290	278	288
10	Beryllium	0.002415	ND	0.00237	ND	0.00255	ND	0.002675	ND
32	Cadmium	3.07	2.85	13.6	6.22	4.2	1.81	12.1	6
Nutrient	Calcium	6050	6200	7540	5960	26300	7760	6310	6255
0.40	Chromium	34.8	33.3	40.5	34.5	30.7	34.4	39.4	36
13	Cobalt	8.74	10.4	7.98	8	7.24	10.1	9.93	11
70	Copper	66.2	39.8	193	104	34.1	34.1	199	114
200	Iron	27600	24000	23200	23500	22300	31200	25800	24550
120	Lead	433	304	2500	1050	176	104	2390	1085
Nutrient	Magnesium	6190	6090	6640	6390	6730	7170	6210	5760
220	Manganese	482	875	760	603	429	771	972	959
0.10	Mercury	0.509	0.193	2.04	0.73	0.34	0.113	1.98	1
38	Nickel	0.885	ND	16.2	0.94	ND	0.98	17.8	0.935
Nutrient	Potassium	6980	6970	7900	7390	5660	8710	7090	5995
1.0	Selenium	0.2215	ND	0.217	ND	0.234	ND	0.218	ND
50.0	Silver	4.07	2.29	19.9	9.67	1.78	0.00985	ND	21
Nutrient	Sodium	610	807	586	674	368	633	721	809
1.0	Thallium	0.00205	ND	0.00201	ND	0.00217	ND	0.00202	ND
2.0	Vanadium	52.8	49.8	46	48.5	52.9	55.1	50	65
120	Zinc	375	264	2270	984	659	160	1860	855
no benchmark	Phosphate, Total (as P)	485	490	973	718	711	912	649	575

Table E-4d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-FT-4E-0	OU3-0-SO-FT-4E-0.501	OU3-0-SO-FT-5E-0	OU3-0-SO-FT-5E-0.501	OU3-0-SO-MRL-14G-0	OU3-0-SO-MRL-14G-0.501	OU3-0-SO-MRL-14H-0	OU3-0-SO-MRL-14H-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501 Dups ave	0	0.501	0	0.501
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	9/25/2015	9/25/2015	9/25/2015	9/25/2015	9/29/2015	9/29/2015	9/29/2015	9/29/2015
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	32500	30600	32000	35600	32500	321000	31300	35400
5	Antimony	13.1	0.175	ND	13.5	0	21.7	9.51	4.93
18	Arsenic	20	16.6	19.2	17	24.2	152	24.5	16.7
330	Barium	327	312	219	249	200	3620	220	315
10	Beryllium	0.00306	ND	0.00287	ND	0.00274	ND	0.02155	ND
32	Cadmium	3.26	1.21	9.86	1	5.44	12.2	3.3	1.84
Nutrient	Calcium	8590	5550	6040	6105	9880	57800	8790	8050
0.40	Chromium	41.6	39.2	33.9	41	39.6	367	39.1	40.1
13	Cobalt	7.8	10.1	8.52	11	7.44	117	9.4	10.1
70	Copper	59.9	24.3	55.1	31	66.5	266	44.2	33.8
200	Iron	22700	22800	24100	28300	24300	255000	24000	26100
120	Lead	375	39.5	288	35	459	422	213	100
Nutrient	Magnesium	7170	6390	5690	6285	6940	61500	6840	7600
220	Manganese	315	380	558	598	410	12800	484	764
0.10	Mercury	2.03	0.0903	1.54	0	0.651	1.49	0.352	0.18
38	Nickel	1.125	ND	1.055	ND	1.005	ND	220	18.9
Nutrient	Potassium	8010	7080	8070	7685	8240	75600	7250	8150
1.0	Selenium	0.28	ND	0.2625	ND	0.251	ND	0.26	ND
50.0	Silver	2.14	0.0108	ND	2.19	0	ND	4.44	0.081
Nutrient	Sodium	445	325	347	364	376	3840	352	382
1.0	Thallium	0.002595	ND	0.002435	ND	0.002325	ND	0.00241	ND
2.0	Vanadium	61.7	48.7	57.6	60	57.8	596	55.1	59.2
120	Zinc	307	149	589	128	1120	1330	522	215
no benchmark	Phosphate, Total (as P)	1240	1070	1190	1295	1200	12100	1090	1140

Table E-4d. (cont.)

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	Sample ID	OU3-0-SO-MRL-14I-0	OU3-0-SO-MRL-14I-0.501	OU3-0-SO-MRL-14J-0	OU3-0-SO-MRL-14J-0.501	OU3-0-SO-MRL-15G-0	OU3-0-SO-MRL-15G-0.501	OU3-0-SO-MRL-15H-0	OU3-0-SO-MRL-15H-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0	0.501
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	9/29/2015	9/29/2015	9/29/2015	9/29/2015	9/29/2015	9/29/2015	9/29/2015	9/29/2015
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	36000	42900	28000	36600	30000	34300	35000	32950
5	Antimony	40.7	29.7	5.48	0.1585	ND	3.9	0.1605	ND
18	Arsenic	43.4	92.5	16.4	12.3	12.7	14	21.9	0
330	Barium	195	196	278	332	204	308	238	295
10	Beryllium	0.00335	ND	0.00281	ND	0.002595	ND	0.002805	ND
32	Cadmium	8.24	6.01	1.88	0.93	1.64	1.29	3.51	1
Nutrient	Calcium	43800	5980	5820	5070	7350	6130	8170	5195
0.40	Chromium	72.5	48.9	36	41.5	69.9	40.3	39.7	39
13	Cobalt	10.1	14.2	11.8	14	7.73	12.5	9.1	11
70	Copper	116	56.7	36.6	18.7	31.8	22.2	41.9	26
200	Iron	24800	34200	24400	29300	22300	25800	25400	25550
120	Lead	1290	804	166	27	83.1	38.9	146	23
Nutrient	Magnesium	9380	7940	4950	6540	6050	6520	6560	5870
220	Manganese	759	1740	991	1180	252	1090	706	932
0.10	Mercury	2.49	0.608	0.154	0.00067	ND	0.154	0.0394	0
38	Nickel	33.6	22.2	18.2	22.8	29.9	20.6	19	22
Nutrient	Potassium	7600	8660	6950	8540	7240	7650	8320	7715
1.0	Selenium	0.307	ND	0.257	ND	0.238	ND	0.241	ND
50.0	Silver	11.3	0.01055	ND	0.0098	ND	0.01055	ND	0
Nutrient	Sodium	434	290	390	333	312	348	406	398
1.0	Thallium	0.002845	ND	0.002385	ND	0.002215	ND	0.00223	ND
2.0	Vanadium	65.7	75.6	59.1	68.2	53.6	63.3	60.8	63
120	Zinc	2170	1960	233	73.8	203	117	426	108
no benchmark	Phosphate, Total (as P)	843	791	880	738	1130	919	770	811

Table E-4d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRL-15I-0	OU3-0-SO-MRL-15I-0.501	OU3-0-SO-MRL-15J-0	OU3-0-SO-MRL-15J-0.501	OU3-0-SO-MRL-15K-0	OU3-0-SO-MRL-15K-0.501	OU3-0-SO-MRL-16G-0
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	9/29/2015	9/29/2015	9/29/2015	9/29/2015	9/29/2015	9/29/2015	9/28/2015
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	33200	36300	40800	34400	29000	38200	33700
5	Antimony	51.5	0.181	ND	244	49.6	0.165	ND
18	Arsenic	62	11.7	223	29.5	11	10.2	ND
330	Barium	237	289	197	309	286	284	216
10	Beryllium	0.00316	ND	0.00296	ND	0.003405	ND	0.002705
32	Cadmium	9.64	1.2	27.5	17.4	1.42	0.942	2.33
Nutrient	Calcium	9420	6350	13900	6090	5900	5330	8400
0.40	Chromium	45	47.5	57.7	49.5	46.2	44.5	34.2
13	Cobalt	12.4	11.8	8.14	10.8	11.9	12.5	9.83
70	Copper	126	21.2	522	83.1	34.4	16.9	48.9
200	Iron	23800	24600	30100	26800	24900	31400	23700
120	Lead	1210	38.3	6640	405	94.3	19.7	209
Nutrient	Magnesium	6830	6760	10800	5810	5210	6990	6290
220	Manganese	1960	940	684	955	1020	844	657
0.10	Mercury	1.81	0.051	11.3	1.17	0.0952	0.000645	ND
38	Nickel	22.9	26.2	1.25	ND	22.5	23.4	18.4
Nutrient	Potassium	7260	7670	9330	7260	8090	7580	8060
1.0	Selenium	0.2895	ND	0.271	ND	0.312	ND	0.2475
50.0	Silver	9.07	0.01115	ND	54.8	2.64	0.0102	ND
Nutrient	Sodium	591	422	571	458	527	665	353
1.0	Thallium	0.00268	ND	0.00251	ND	0.00289	ND	0.002295
2.0	Vanadium	65.3	61	76.7	63.6	58.5	70.9	47.3
120	Zinc	1660	115	7800	2890	148	76.6	407
no benchmark	Phosphate, Total (as P)	874	546	1520	748	975	556	1740

Table E-4d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRL-16G-0.501	OU3-0-SO-MRL-16I-0	OU3-0-SO-MRL-16I-0.501	OU3-0-SO-MRL-16J-0	OU3-0-SO-MRL-16J-0.501	OU3-0-SO-MRL-16K-0	OU3-0-SO-MRL-16K-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0.501	0	0.501	0	0.501 Dups ave	0	0.501 Dups ave
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	9/28/2015	9/28/2015	9/28/2015	9/28/2015	9/28/2015	9/29/2015	9/29/2015
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	34900	36000	35800	35500	30000	38900	34300
5	Antimony	3.91	37.7	0.165	ND	16.8	0	ND
18	Arsenic	14	41.8	13.5	25.1	15	75.1	62
330	Barium	314	197	325	241	273	335	256
10	Beryllium	0.002585	ND	0.002825	ND	0.0027	ND	0.002985
32	Cadmium	1.72	6.03	1.12	4.32	1	12.2	11
Nutrient	Calcium	5950	7790	5420	7500	5060	18100	11850
0.40	Chromium	34.7	39.7	37.8	41	41	42.9	37
13	Cobalt	13.2	8.31	15.4	8.48	16	12.3	12
70	Copper	30.9	94.9	22.7	54	9	165	135
200	Iron	24500	24900	26100	27400	32050	27400	26400
120	Lead	60	1010	32.4	256	25	1710	1385
Nutrient	Magnesium	6120	6940	6310	6250	8635	8370	7485
220	Manganese	1540	424	1380	430	1388	1550	1190
0.10	Mercury	0.000685	ND	1.03	0.0475	0.373	0	ND
38	Nickel	21	19.1	21.1	19.3	27	21.6	20
Nutrient	Potassium	7480	8270	7800	7440	4850	8540	6865
1.0	Selenium	0.237	ND	0.259	ND	0.247	ND	0
50.0	Silver	0.00975	ND	7.26	0.01015	ND	0	ND
Nutrient	Sodium	359	339	350	488	305	460	351
1.0	Thallium	0.002195	ND	0.0024	ND	0.00229	ND	0
2.0	Vanadium	53.7	52.4	56.3	61.7	64	77.4	71
120	Zinc	173	1330	92.6	622	81	2610	2035
no benchmark	Phosphate, Total (as P)	804	816	796	567	687	1080	804

Table E-4d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRL-17G-0	OU3-0-SO-MRL-17G-0.501	OU3-0-SO-MRL-17H-0	OU3-0-SO-MRL-17H-0.501	OU3-0-SO-MRL-18G-0	OU3-0-SO-MRL-18G-0.501	OU3-0-SO-MRL-19G-0	OU3-0-SO-MRL-19G-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0	0.501
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	9/29/2015	9/29/2015	9/29/2015	9/29/2015	9/29/2015	9/29/2015	9/29/2015	9/29/2015
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	33000	29200	35400	31900	34500	34800	40200	44400
5	Antimony	4.09	0.1555	ND	4.12	0.157	ND	0.165	ND
18	Arsenic	17.1	11.8	18	14.7	19.3	19.4	19.9	30.4
330	Barium	201	246	267	243	332	205	306	230
10	Beryllium	0.002775	ND	0.00254	ND	0.00257	ND	0.002695	ND
32	Cadmium	2.23	0.989	1.63	0.97	1.82	0.89	1.8	1.57
Nutrient	Calcium	10700	5340	6820	5260	8060	7390	6760	5280
0.40	Chromium	33.6	36.2	33.9	31.1	42.9	41.2	40.1	66.5
13	Cobalt	9.42	11	12.6	12.2	11.3	11.2	14.2	12.7
70	Copper	34	25.4	34.4	24.6	45.9	34.3	34.8	25.3
200	Iron	24700	23500	28700	26400	28300	26400	29100	32100
120	Lead	83.8	29	83.9	31.1	109	45.7	83.2	41.9
Nutrient	Magnesium	6200	5330	5760	5370	7010	7160	6690	8250
220	Manganese	556	956	921	1090	1090	753	1310	1070
0.10	Mercury	0.141	0.121	0.122	0.00068	ND	0.231	0.127	0.00078
38	Nickel	1.02	ND	21.2	21.7	19.9	23	20.9	29.9
Nutrient	Potassium	7140	6010	6890	5940	8940	8710	9550	9060
1.0	Selenium	0.254	ND	0.233	ND	0.247	ND	0.247	ND
50.0	Silver	0.01045	ND	0.00955	ND	0.01015	ND	0.01015	ND
Nutrient	Sodium	337	294	271	253	483	369	388	353
1.0	Thallium	0.002355	ND	0.002155	ND	0.00229	ND	0.00229	ND
2.0	Vanadium	67.5	66.1	71.9	75.5	65.6	62.7	69.6	84.4
120	Zinc	341	104	186	93.6	245	144	192	118
no benchmark	Phosphate, Total (as P)	1020	997	1090	811	1450	1500	1030	1030

Table E-4d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRU-10B-0	OU3-0-SO-MRU-10B-0.501	OU3-0-SO-MRU-12B-0	OU3-0-SO-MRU-12B-0.501	OU3-0-SO-MRU-12E-0	OU3-0-SO-MRU-12E-0.501	OU3-0-SO-MRU-13B-0	OU3-0-SO-MRU-13B-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0	0.501
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	9/30/2015	9/30/2015	9/30/2015	9/30/2015	10/1/2015	10/1/2015	9/30/2015	9/30/2015
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	27100	29700	26600	3450	28600	30500	37600	35500
5	Antimony	12.9	0.1445	ND	22.1	6.68	37	24	0.1645
18	Arsenic	22.6	10.5	39.3	130	22	48.8	37.5	20.2
330	Barium	331	330	318	609	289	287	460	574
10	Beryllium	0.002715	ND	0.002365	ND	0.002995	ND	0.00263	ND
32	Cadmium	4.01	1.13	11	98.3	2.95	8.69	4.53	0.0076
Nutrient	Calcium	6630	5240	15100	23200	12000	7620	5630	4220
0.40	Chromium	32.6	33.1	45.7	18.3	131	40.5	30.8	29
13	Cobalt	13.3	12.7	8.71	0.0765	ND	9.56	11.2	18.6
70	Copper	60	28.1	294	197	39.5	90	62	20.9
200	Iron	27500	28600	36400	59100	22300	26400	28600	29300
120	Lead	247	55.2	925	18800	191	1150	702	47.4
Nutrient	Magnesium	4520	4170	6120	481	8150	6410	4480	3690
220	Manganese	838	752	662	88.2	1230	1160	1070	1490
0.10	Mercury	0.712	0.0445	0.709	5.11	0.211	1.29	1.33	0.0886
38	Nickel	19.8	19.5	1.08	ND	1.1	26.8	18.7	18.3
Nutrient	Potassium	6600	6920	6550	3050	8800	7120	8580	7550
1.0	Selenium	0.2485	ND	0.2165	ND	0.2695	ND	0.2405	ND
50.0	Silver	2.52	0.0089	ND	5.11	76.3	0.0114	5.96	2.96
Nutrient	Sodium	294	263	2310	560	385	275	224	214
1.0	Thallium	0.002305	ND	0.002005	ND	0.002495	ND	0.002565	ND
2.0	Vanadium	68.3	70.8	46.5	0.086	ND	50	55.3	62.8
120	Zinc	861	190	1940	15900	328	1810	993	66.6
no benchmark	Phosphate, Total (as P)	1240	1180	625	97.7	3340	1340	1100	1070

Table E-4d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRU-1B-0	OU3-0-SO-MRU-1B-0.5-1	OU3-0-SO-MRU-3A-0	OU3-0-SO-MRU-3A-0.501	OU3-0-SO-MRU-3B-0	OU3-0-SO-MRU-3B-0.501	OU3-0-SO-MRU-4A-0	OU3-0-SO-MRU-4A-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.5-1	0	0.501	0	0.501	0	0.501
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	11/10/2014	11/10/2014	11/10/2014	11/10/2014	11/10/2014	11/10/2014	11/10/2014	11/10/2014
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	18300	25500	28100	36900	24200	32700	30000	36600
5	Antimony	37.3	0.218	ND	29	0.2235	112	11.7	8.16
18	Arsenic	42	13.4	33.9	10.8	98.7	19.5	16.8	16.3
330	Barium	200	301	261	285	302	319	253	269
10	Beryllium	0.003125	ND	0.00357	ND	0.003235	ND	0.0036	ND
32	Cadmium	10.9	2.97	6.67	1.23	17.4	1.76	2.94	2.1
Nutrient	Calcium	10700	15900	15200	22700	13100	12700	21400	19300
0.40	Chromium	72.1	124	91	117	73.7	94.2	74.5	89.1
13	Cobalt	6.9	9.92	8.54	9.73	10.6	9.86	10.8	10.7
70	Copper	89.3	27.1	97.3	39.9	210	40.6	76.1	91.9
200	Iron	15800	17100	21100	25200	20600	23200	26300	26800
120	Lead	1170	49.1	914	16.5	3040	83.6	213	108
Nutrient	Magnesium	3480	4050	5630	6750	4620	5590	6020	6680
220	Manganese	788	929	1090	1010	1850	977	1590	1450
0.10	Mercury	0.712	0.106	1.15	0.00177	ND	0.526	0.36	0.153
38	Nickel	1.15	ND	25.8	1.19	ND	29.1	22.8	25.1
Nutrient	Potassium	5060	6330	8660	10900	6640	8830	8930	11000
1.0	Selenium	0.2865	ND	0.327	ND	0.2965	ND	0.3295	ND
50.0	Silver	6.53	0.01345	ND	6.93	0.0138	ND	13.9	0.01355
Nutrient	Sodium	352	4.625	ND	452	561	416	465	424
1.0	Thallium	0.002655	ND	0.00303	ND	0.002745	ND	0.002635	ND
2.0	Vanadium	37.9	0.082	ND	51.4	66.7	49.3	58.8	55.1
120	Zinc	1380	0.1145	ND	994	116	2260	216	424
no benchmark	Phosphate, Total (as P)	4020	4870	5460	1750	4170	6510	68400	5100

Table E-4d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRU-4B-0	OU3-0-SO-MRU-4B-0.501	OU3-0-SO-MRU-5B-0	OU3-0-SO-MRU-5B-0.501	OU3-0-SO-MRU-6A-0	OU3-0-SO-MRU-6A-0.501	OU3-0-SO-MRU-6B-0	OU3-0-SO-MRU-6B-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0	0.501
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	11/10/2014	11/10/2014	11/11/2014	11/11/2014	11/11/2014	11/11/2014	11/11/2014	11/11/2014
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	17100	37400	12700	9910	20900	29500	14900	13600
5	Antimony	61.7	13.9	23.4	23.9	14.3	0.221	ND	0.2435
18	Arsenic	42.8	19.9	26.6	30.2	22	12.9	5.55	15.7
330	Barium	228	321	181	286	256	365	164	263
10	Beryllium	0.00314	ND	0.003585	ND	0.00486	ND	0.003235	ND
32	Cadmium	14.1	2.86	9.99	33.8	3.47	1.72	0.0113	ND
Nutrient	Calcium	17300	12400	13900	15600	27600	28100	16300	32300
0.40	Chromium	40.1	91	17.6	1.985	ND	67.7	108	28.8
13	Cobalt	6.11	11.8	3.56	3.51	7.88	9.23	5.05	5.5
70	Copper	152	107	74.4	95.3	37	28.8	1.025	ND
200	Iron	14100	25200	11600	17900	18800	25400	12100	12900
120	Lead	1600	316	744	764	371	91.7	21.4	117
Nutrient	Magnesium	4010	6350	2750	1870	6710	6090	7610	14100
220	Manganese	984	1460	269	542	956	1280	354	684
0.10	Mercury	2.54	1.33	0.783	1.21	0.606	0.296	0.00175	ND
38	Nickel	1.155	ND	28.1	1.235	ND	1.185	26.5	1.465
Nutrient	Potassium	5740	11900	2190	1320	5940	7460	3360	3630
1.0	Selenium	0.288	ND	0.3285	ND	0.445	ND	0.331	ND
50.0	Silver	6.9	0.0135	ND	2.92	2.88	0.01215	ND	0.0136
Nutrient	Sodium	330	467	697	970	425	634	212	262
1.0	Thallium	0.002665	ND	0.003045	ND	0.004125	ND	0.00307	ND
2.0	Vanadium	33.6	66.9	20.7	16.1	43.5	62	30.9	32.2
120	Zinc	1150	366	1610	7640	468	187	67.4	241
no benchmark	Phosphate, Total (as P)	1900	7710	1200	740	2680	13800	436	2960

Table E-4d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRU-6D-0	OU3-0-SO-MRU-6D-0.501	OU3-0-SO-MRU-7B-0	OU3-0-SO-MRU-7B-0.501	OU3-0-SO-MRU-8B-0	OU3-0-SO-MRU-8B-0.501	OU3-0-SO-MRU-8D-0	OU3-0-SO-MRU-8D-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0	0.501	0	0.501
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	11/12/2014	11/12/2014	9/30/2015	9/30/2015	9/30/2015	9/30/2015	10/1/2015	10/1/2015
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	22100	27500	17700	33900	25400	5290	35400	31000
5	Antimony	16.7	94.1	28.5	3.98	213	268	8.23	0.1525
18	Arsenic	24.3	88.9	31.7	12.2	244	265	18.3	18.6
330	Barium	207	209	154	406	269	305	228	236
10	Beryllium	0.00284	ND	0.00324	ND	0.00243	ND	0.00255	ND
32	Cadmium	7.88	23.8	5.59	1.16	41.6	42.7	2.68	0.906
Nutrient	Calcium	11200	19000	64300	8980	20100	4350	13500	11800
0.40	Chromium	29.4	40.3	24.3	47.1	69.4	29.9	43.7	40.2
13	Cobalt	9.16	13	5.87	10.1	14.8	5.46	14.4	12.1
70	Copper	48	168	64.1	20	473	138	35.9	20.5
200	Iron	19400	25200	16600	25200	33200	94700	30700	30900
120	Lead	511	2450	906	81.1	6610	6140	217	68
Nutrient	Magnesium	8320	11300	5550	4510	11700	2210	11100	9490
220	Manganese	1480	777	2810	824	4600	213	1060	1140
0.10	Mercury	0.815	3.8	0.993	0.238	17.7	10.3	0.284	0.139
Nutrient	Potassium	7360	10200	4750	9300	5830	1630	5010	4840
1.0	Selenium	0.2605	ND	0.2965	ND	0.2225	ND	0.298	ND
50.0	Silver	2.78	12.4	4.42	0.0099	ND	50.2	36.8	0.0123
Nutrient	Sodium	242	327	295	258	368	400	747	840
1.0	Thallium	0.00241	ND	0.00275	ND	0.002065	ND	0.002225	ND
2.0	Vanadium	49	70.4	41	68.5	78.6	35	68.2	58
120	Zinc	1130	4360	908	127	9290	7090	402	132
no benchmark	Phosphate, Total (as P)	1010	1010	2230	1090	1710	1660	1240	1260

Table E-4d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRU-9B-0	OU3-0-SO-NR-11M-0.501	OU3-0-SO-NR-12Q-0	OU3-0-SO-NR-12Q-0.501	OU3-0-SO-NR-15K-0.501	OU3-0-SO-NR-16K-0.501	OU3-0-SO-NR-2C-0	OU3-0-SO-NR-2C-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0.501	0.501	0	0.501
	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	9/30/2015	9/21/2015	10/5/2015	10/5/2015	9/17/2015	9/17/2015	9/22/2015	9/22/2015
	Habitat	Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
50	Aluminum	29100	29100	17300	37900	30600	23400	20900	26900
5	Antimony	21.5	0.162	ND	0.164	ND	23.2	179	7.28
18	Arsenic	34.3	8.82	8.36	8.53	23.2	233	10.9	6.32
330	Barium	221	219	105	150	273	286	348	393
10	Beryllium	0.00262	ND	0.00265	ND	0.002485	ND	0.002595	ND
32	Cadmium	5.05	1.67	0.833	0.00705	ND	3.46	21.7	3.07
Nutrient	Calcium	5800	3890	2700	4000	6270	23400	8660	8900
0.40	Chromium	41	29.3	20.2	33.3	34.5	39.2	32.2	37.2
13	Cobalt	15.7	8.58	6.05	8.29	10.7	9.34	10.9	13.4
70	Copper	51.8	27.3	17.1	0.64	55.2	331	43	30
200	Iron	32500	18800	13100	24300	26100	27500	25200	30300
120	Lead	495	26.4	42.4	14.7	269	3650	251	18.9
Nutrient	Magnesium	6200	4390	3110	8060	5860	12200	5270	5900
220	Manganese	965	633	382	291	730	1600	706	881
0.10	Mercury	1.02	0.239	0.162	0.000725	ND	0.294	4.42	0.263
38	Nickel	23.4	0.975	ND	0.985	19	17.5	1.27	ND
Nutrient	Potassium	5070	9190	4800	6480	6970	5030	5050	6450
1.0	Selenium	0.24	ND	0.243	ND	0.246	ND	0.2375	ND
50.0	Silver	3.15	0.01	ND	0.0101	ND	0.00935	ND	0.01025
Nutrient	Sodium	238	392	293	562	591	626	1670	1710
1.0	Thallium	0.002225	ND	0.00225	ND	0.00228	ND	9.14	0.002145
2.0	Vanadium	79.6	40.6	33.6	51	57.9	50.6	60.6	72.1
120	Zinc	971	97.8	60.1	46.9	327	4700	333	83.6
no benchmark	Phosphate, Total (as P)	1290	637	291	264	828	1610	1420	1250

Table E-4d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-NR-2F-0	OU3-0-SO-NR-2F-0.501	OU3-0-SO-NR-4J-0	OU3-0-SO-NR-4J-0.501	OU3-0-SO-NR-9K-0.501
Lowest Toxicity Benchmark for Plants and Soil Organisms (mg/kg)	Depth	0	0.501	0	0.501	0.501
	Operable Unit	OU3	OU3	OU3	OU3	OU3
	Sample date	9/22/2015	9/22/2015	9/22/2015	9/22/2015	9/24/2015
	Habitat	Upland	Upland	Upland	Upland	Upland
50	Aluminum	24400	30600	30500	28400	38200
5	Antimony	7.25	0.1645	ND	0.1445	ND
18	Arsenic	13.9	8	47.2	6.94	517
330	Barium	241	163	234	219	376
10	Beryllium	0.0025	ND	0.00269	ND	0.00237
32	Cadmium	2.67	0.0076	ND	1.18	1.02
Nutrient	Calcium	8800	3970	7330	5760	6000
0.40	Chromium	32.3	32.2	42.4	42.1	36
13	Cobalt	8.13	6.89	9.73	9.3	6.56
70	Copper	34.7	0.695	ND	19.5	14.3
200	Iron	19700	19400	24500	24600	18800
120	Lead	233	16.5	77.4	31.9	13000
Nutrient	Magnesium	5850	5010	7550	6590	4360
220	Manganese	472	276	318	247	853
0.10	Mercury	0.322	0.00071	ND	0.0772	0.0608
38	Nickel	0.92	ND	0.99	ND	17.9
Nutrient	Potassium	5740	6070	7030	6390	5090
1.0	Selenium	0.229	ND	0.2465	ND	0.217
50.0	Silver	1.37	0.01015	ND	0.0089	ND
Nutrient	Sodium	459	270	526	443	2220
1.0	Thallium	0.00212	ND	0.002285	ND	0.00201
2.0	Vanadium	45.1	40.9	83.8	74.2	44.4
120	Zinc	348	55.9	104	81.5	9880
no benchmark	Phosphate, Total (as P)	983	605	1060	962	1260

Notes:

Samples were collected November 2014 to October 2015

All samples analyzed by laboratory as bulk samples.

Results reported as mg/kg

Non-detects are reported at half the detection limit

Duplicate samples have been averaged

Sampling Depth:

0 is a surface sample; collected at 0-2 inches

0.501 is taken between 6 inches and 1 foot beneath surface

Benchmarks are the lowest value of the EcoSSLs for plants and soil invertebrates, or the ORNL LOEC for plants, soil organisms, and microbes

Key:

ER = OU3 P.C. East Reach

FT = OU3 Floodplain Tailings Reach

ID = Identification

mg/kg = milligrams per kilogram

MR# = OU3 Middle Reach Boring Sample Collected during piezometer installation; See Figure 1-3 for piezometer location

MRL = OU3 Middle Reach Lower

MRU = OU3 Middle Reach Upper

ND = Non-Detect

NR = OU3 State Route 248 North Reach

OU3 = Richardson Flat Tailings Site Operable Unit 3

SO = Soil

WR = OU3 P.C. West Reach

Table E-5a. Screening results for OU2 Floodplain soil samples compared with benchmarks for effects to wildlife

DRAFT

Lowest Eco-SSL TRV (mg/kg)	Sample ID Depth Operable Unit Sample date Habitat	OU2-0-SO-10E-0.501							OU2-0-SO-10L-0		OU2-0-SO-10L-0.501		OU2-0-SO-12I-0		OU2-0-SO-12I-0.501	
		N	count of NDs	% detected	Minimum	Maximum	Average	OU2 Floodplain	9/17/2015	OU2 Floodplain	9/21/2015	OU2 Floodplain	9/21/2015	OU2 Floodplain	9/17/2015	OU2 Floodplain
no benchmark	Aluminum	84	0	100%	2040	36800	14153	30200	27400	31400	18200	5590				
0.27	Antimony	84	14	83%	0.154	5490	403	38.6	16.7	0.173	ND	1550	1440			
43	Arsenic	84	0	100%	3.26	7010	491	41.9	10.5	10	ND	1350	5300			
2000	Barium	84	0	100%	40	1360	235	272	195	206	227	229				
21	Beryllium	84	84	0%	0.0022	0.006525	0	0.00268	ND	0.00302	ND	0.00283	ND	0.00249	ND	0.003215
0.36	Cadmium	84	2	98%	0.00785	206	60	5.76	15.7	1.01	ND	206	195			
no benchmark	Calcium	84	0	100%	4970	117000	32806	5790	6830	5340	39100	5810				
26	Chromium	84	2	98%	1.02	123	34	35.3	34.1	30.9	123	20.1				
120	Cobalt	84	1	99%	0.16625	33.7	9	9.63	5.77	7.96	3.97	33.7				
28	Copper	84	1	99%	0.775	2725	509	79.1	34.9	21.8	2450	1950				
no benchmark	Iron	84	0	100%	3340	138000	28976	26100	20500	21100	24000	138000				
11	Lead	84	2	98%	14.95	47000	7416	544	15.2	ND	23.5	34400	29700			
no benchmark	Magnesium	84	0	100%	2700	40000	10738	5870	6220	5950	17700	2700				
4000	Manganese	84	0	100%	142	5910	1769	888	183	317	3650	2450				
no benchmark	Mercury	84	7	92%	0.000625	201.5	12	0.452	0.202	0.0512	31.3	89.6				
130	Nickel	84	75	11%	0.81	24.4	3	0.985	ND	1.11	ND	1.04	ND	0.915	ND	1.18
no benchmark	Potassium	84	0	100%	848	9670	3892	6060	7520	7910	6500	1310				
0.63	Selenium	84	47	44%	0.2225	34.6	6	0.2455	ND	0.2765	ND	0.2595	ND	20.5	13.1	
4.2	Silver	84	20	76%	0.0094	236	40	4.65	0.01135	ND	0.01065	ND	236	102		
no benchmark	Sodium	84	4	95%	3.935	3430	468	428	1020	735	473	658				
no benchmark	Thallium	84	42	50%	0.002063	45.7	5	0.002275	ND	0.00256	ND	0.0024	ND	11.9	5.91	
7.8	Vanadium	84	5	94%	0.0745	122	26	53.5	40.3	42.3	41.8	0.0925	ND			
46	Zinc	84	0	100%	55.3	65600	12186	666	1370	90.4	31300	43700				
no benchmark	Phosphate, Total (as P)	84	0	100%	261	5180	1439	725	905	624	3710	1310				

Table E-5a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-12L-0	OU2-0-SO-12L-0-501	OU2-0-SO-13H-0-501	OU2-0-SO-14C-0-501	OU2-0-SO-15L-0	OU2-0-SO-15L-0-501	OU2-0-SO-15N-0	OU2-0-SO-15N-0-501
Lowest Eco-SSL TRV (mg/kg)	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
	Sample date	9/21/2015	9/21/2015	9/17/2015	9/22/2015	9/17/2015	9/17/2015	9/16/2015	9/16/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
no benchmark	Aluminum	7900	36600	20000	33000	3350	15900	6830	6060
0.27	Antimony	874	10.2	0.1695	ND	847	830	304	351
43	Arsenic	649	14.5	7.73	9.56	757	449	258	383
2000	Barium	185	285	165	323	63.8	137	236	393
21	Beryllium	0.00264	ND	0.00297	ND	0.00316	ND	0.00437	ND
0.36	Cadmium	79.6	18.9	0.00785	ND	1.42	175	77	37.4
no benchmark	Calcium	25000	7710	4970	5840	74700	48300	42000	39300
26	Chromium	30	37.1	31	39.2	1.785	ND	54	34.5
120	Cobalt	2.69	10.6	9.26	11.8	7.29	2	6.91	5.32
28	Copper	1670	42.3	18.9	30.2	252	1090	385	540
no benchmark	Iron	15300	25200	18300	28100	11200	13400	31600	43400
11	Lead	16900	14.95	ND	19.1	28.7	1830	17600	7680
no benchmark	Magnesium	8680	7440	4930	6280	3610	10900	14300	15100
4000	Manganese	1730	788	576	846	350	1720	1670	1990
no benchmark	Mercury	26	0.172	0.0506	0.000755	ND	1.88	6	9.38
130	Nickel	0.97	1.09	ND	1.02	ND	1.605	1	1.05
no benchmark	Potassium	2350	9670	4880	7870	942	ND	5250	2280
0.63	Selenium	10.2	0.272	ND	0.2545	ND	0.4	0	10.8
4.2	Silver	120	0.0112	ND	0.01045	ND	7.02	112	41.3
no benchmark	Sodium	399	919	389	737	1350	239	285	187
no benchmark	Thallium	0.00224	ND	0.00252	ND	0.002355	ND	24.9	7
7.8	Vanadium	18.9	44	41	56.4	5.9	33	18.8	19.9
46	Zinc	20300	2780	59.5	107	65600	12300	11100	9620
no benchmark	Phosphate, Total (as P)	1460	931	862	867	419	2090	2050	1830

Table E-5a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-16H-0.501	OU2-0-SO-17L-0	OU2-0-SO-17L-0.501	OU2-0-SO-17N-0	OU2-0-SO-17N-0.501	OU2-0-SO-23O-0.501	OU2-0-SO-25R-0.501	OU2-0-SO-26O-0.501
Lowest Eco-SSL TRV (mg/kg)	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
	Sample date	9/17/2015	9/17/2015	9/17/2015	9/16/2015	9/16/2015	9/16/2015	9/16/2015	9/15/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
no benchmark	Aluminum	27200	30200	36800	3580	4070	7525	3760	20500
0.27	Antimony	5.75	11.4	0.194	ND	413	928	577.5	223
43	Arsenic	12	23.8	7.19	ND	406	701	514	310
2000	Barium	244	319	284	99.4	83.4	189	134	112.45
21	Beryllium	0.003055	ND	0.002705	ND	0.003175	ND	0.002675	ND
0.36	Cadmium	1.69	4.08	1.14	ND	69	83.6	89.8	79.5
no benchmark	Calcium	9110	7300	6420	43500	40100	42300	40400	16090
26	Chromium	35.1	39.3	34.9	17.7	19.8	45.1	19.1	85.05
120	Cobalt	14.3	11.8	8.03	2.2	3.12	6.88	6.35	0.16625
28	Copper	29	46.2	24.6	579	671	771.5	380	2580
no benchmark	Iron	26200	34800	26400	11100	15300	26200	45200	17050
11	Lead	80.7	272	16	7900	15100	10550	5590	35300
no benchmark	Magnesium	5750	6140	7340	12000	10300	10350	15000	10205
4000	Manganese	932	1070	635	2100	2930	2375	2250	517.5
no benchmark	Mercury	0.207	0.424	0.000885	ND	8.23	9.01	15.5	3.63
130	Nickel	1.12	ND	18.6	1.165	ND	0.98	1.13	38.9
no benchmark	Potassium	6240	6150	8480	1270	2190	2245	1660	2.3925
0.63	Selenium	0.2795	ND	0.248	ND	0.2905	ND	12	10.99
4.2	Silver	0.0115	ND	1.6	0.01195	ND	55.2	90.8	58.15
no benchmark	Sodium	625	944	659	162	413	394	151	407.5
no benchmark	Thallium	0.00259	ND	0.002295	ND	0.002695	ND	5.33	3.81
7.8	Vanadium	61	40.6	51.9	11.4	13.5	22.8	10.8	45.5
46	Zinc	132	427	86.7	17200	18500	17450	16700	21250
no benchmark	Phosphate, Total (as P)	685	863	767	1660	1280	895.5	504	2985

Table E-5a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-26S-0.501	OU2-0-SO-26V-0	OU2-0-SO-26V-0.501	OU2-0-SO-30R-0	OU2-0-SO-30R-0.501	OU2-0-SO-30U-0.501	OU2-0-SO-30Y-0	OU2-0-SO-30Y-0.501
	Depth	0.501	0	0.501	0	0.501	0.501	0	0.501
Lowest Eco-SSL TRV (mg/kg)	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
	Sample date	9/15/2015	9/16/2015	9/16/2015	9/15/2015	9/15/2015	9/15/2015	9/16/2015	9/16/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
no benchmark	Aluminum	11600	3370	4770	5600	6150	5320	4610	4220
0.27	Antimony	772	132	189	489	395	269	234	197
43	Arsenic	479	217	240	335	295	245	335	317
2000	Barium	263	161	258	119	53.7	125	184	115
21	Beryllium	0.00414	ND	0.00264	ND	0.00246	ND	0.002445	ND
0.36	Cadmium	91.4	27.3	42.3	54	47.9	44.7	93.1	52
no benchmark	Calcium	30300	38100	45700	27500	29900	41400	57000	55400
26	Chromium	25.5	20.6	24	26	20.5	26.4	25.9	38
120	Cobalt	12.9	2.5	2.6	2.2	1.61	12.6	8.04	5
28	Copper	1210	125	237	873	698	303	337	219
no benchmark	Iron	59300	16100	26700	10400	10100	18700	46500	32200
11	Lead	14700	2810	4130	13900	8090	4150	6410	3710
no benchmark	Magnesium	11500	14900	17000	7660	6480	12800	18500	19300
4000	Manganese	1860	1700	1940	1420	1370	5080	2460	1650
no benchmark	Mercury	52.1	1.65	4.17	17.7	10.5	3.93	4.82	2
130	Nickel	1.52	0.97	ND	0.98	0.905	ND	0.93	0.955
no benchmark	Potassium	2150	1440	2170	1560	1900	1690	2070	1930
0.63	Selenium	19.4	0.2415	ND	9.07	0.2255	ND	0.2325	ND
4.2	Silver	85.7	17	23.7	60.6	44.6	19.8	34.2	29
no benchmark	Sodium	367	127	213	280	222	168	278	242
no benchmark	Thallium	0.003515	ND	0.00224	ND	4.13	3.33	0.002075	ND
7.8	Vanadium	24.5	10.4	13.5	11.6	13	7.85	15.2	12
46	Zinc	18300	4430	6940	17200	13400	8160	15400	8160
no benchmark	Phosphate, Total (as P)	1530	1480	1460	1390	1120	1100	1330	1400

Table E-5a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-31X-0.501	OU2-0-SO-32V-0.501	OU2-0-SO-33F-0.501	OU2-0-SO-33X-0.501	OU2-0-SO-34G-0.501	OU2-0-SO-34G-0.501	OU2-0-SO-34Z-0.501	OU2-0-SO-35V-0.501
Lowest Eco-SSL TRV (mg/kg)	Operable Unit	OU2							
	Sample date	8/5/2015	8/5/2015	8/5/2015	8/5/2015	8/5/2015	8/5/2015	8/5/2015	8/5/2015
	Habitat	Floodplain							
no benchmark	Aluminum	6320	6135	35900	4840	7530	27400	3410	12000
0.27	Antimony	290	254.5	0.165	ND	140	63	0.154	ND
43	Arsenic	337	237	10	ND	253	110	9.95	ND
2000	Barium	159	97.1	322	97	159	287	176	196
21	Beryllium	0.00335	0.00324	ND	0.002705	0	ND	0.00263	ND
0.36	Cadmium	75.8	32.45	1.27	ND	66	63.6	1.46	ND
no benchmark	Calcium	43800	29300	5300	53800	41400	5490	44500	24200
26	Chromium	23.4	20.2	44	22	10.9	33.5	16.8	15
120	Cobalt	11.5	3.825	13.9	5	12.2	12.1	5.54	14.5
28	Copper	413	421	27.6	244	126	33.1	287	89.7
no benchmark	Iron	46600	12200	32000	26400	11900	24100	35000	26100
11	Lead	5530	3780	36	4620	605	44.6	4090	1110
no benchmark	Magnesium	11200	7310	6920	15600	3480	5390	15400	4670
4000	Manganese	1560	1520	860	1520	1770	803	1400	2420
no benchmark	Mercury	6.78	6.845	ND	0.0444	2	0.642	0.0462	ND
130	Nickel	1.23	1.19	ND	22.3	1	ND	0.965	0.265
no benchmark	Potassium	1830	1730	6970	1960	1900	5580	1460	2910
0.63	Selenium	20.1	0.29675	ND	0.2475	11	0.2405	0.2305	ND
4.2	Silver	23.8	13.95	0.0102	ND	23	5.58	0.0095	ND
no benchmark	Sodium	270	202.5	448	4	ND	202	450	126
no benchmark	Thallium	0.002845	ND	5.665	0.002295	0	ND	7.29	0.002135
7.8	Vanadium	0.828	9.365	67.4	5	14.1	55.4	0.0745	ND
46	Zinc	17200	9030	107	10200	7970	124	11800	2680
no benchmark	Phosphate, Total (as P)	1260	1165	751	1110	1040	710	780	913

Table E-5a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-35V-0.501	OU2-0-SO-37V-0	OU2-0-SO-37V-0.501	OU2-0-SO-39V-0	OU2-0-SO-39V-0.501	OU2-0-SO-43T-0	OU2-0-SO-43T-0.501	OU2-0-SO-44T-0
Lowest Eco-SSL TRV (mg/kg)	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
	Sample date	8/5/2015	8/5/2015	8/5/2015	8/4/2015	8/4/2015	8/4/2015	8/4/2015	9/14/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
no benchmark	Aluminum	27000	20000	25600	12800	29500	2940	26000	6960
0.27	Antimony	0.2135	ND	24.8	0.226	ND	320	105	3.78
43	Arsenic	20.6	ND	48.7	11.8	ND	306	76.2	4.23
2000	Barium	288	ND	269	271	ND	336	256	77.7
21	Beryllium	0.00349	ND	0.0025	ND	0.003695	ND	0.00244	ND
0.36	Cadmium	1.47	ND	5.52	1.11	ND	55.3	17.6	3
no benchmark	Calcium	7900	ND	27800	7230	ND	15000	7960	117000
26	Chromium	32.1	ND	24	33.4	ND	22.5	44.4	1.02
120	Cobalt	9.01	ND	8.61	8.29	ND	27.9	7.39	1.88
28	Copper	19.1	ND	76.7	22.6	ND	411	278	31.5
no benchmark	Iron	20700	ND	20100	19300	ND	20900	22100	3340
11	Lead	27.3	ND	616	28.3	ND	9200	4140	51.6
no benchmark	Magnesium	7620	ND	6790	7450	ND	4000	6240	4650
4000	Manganese	148	ND	266	152	ND	3850	380	2820
no benchmark	Mercury	0.000745	ND	1.8	0.00073	ND	23.9	18.9	0.298
130	Nickel	1.28	ND	0.92	ND	0.895	ND	0.995	0.915
no benchmark	Potassium	5990	ND	5070	6680	ND	3630	6530	1540
0.63	Selenium	0.32	ND	0.229	ND	0.3385	ND	8.57	0.2475
4.2	Silver	0.01315	ND	3.48	0.0139	ND	24.7	14.7	0.2285
no benchmark	Sodium	707	ND	587	670	ND	278	538	0.0094
no benchmark	Thallium	0.002965	ND	0.002125	ND	0.00314	ND	0.002295	ND
7.8	Vanadium	49.4	ND	31.8	45.6	ND	25.8	51.4	5.56
46	Zinc	164	ND	995	131	ND	6590	1450	289
no benchmark	Phosphate, Total (as P)	796	ND	721	1060	ND	1320	938	844
									629
									1740

Table E-5a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-44T-0.501	OU2-0-SO-44V-0	OU2-0-SO-44V-0.501	OU2-0-SO-44W-0	OU2-0-SO-44W-0.501	OU2-0-SO-45T-0	OU2-0-SO-45T-0.501	OU2-0-SO-45V-0
	Depth	0.501	0	0.501	0	0.501	0	0.501	0
Lowest Eco-SSL TRV (mg/kg)	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
	Sample date	9/14/2015	7/31/2015	7/31/2015	7/31/2015	7/31/2015	7/30/2015	7/30/2015	7/30/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
no benchmark	Aluminum	15300	20500	7730	10200	11000	11300	6410	6470
0.27	Antimony	468	570	291	344	479	513	219	224
43	Arsenic	581	550	363	442	395	589	296	241
2000	Barium	482	298	314	224	223	330	148	171
21	Beryllium	0.00293	ND	0.003105	ND	0.00328	ND	0.0022	ND
0.36	Cadmium	103	86.5	65.1	180	82.5	105	43.4	65.4
no benchmark	Calcium	75100	41800	51300	44700	55600	69600	52400	50200
26	Chromium	65	65.4	35.4	30.3	62.2	49.5	25	33.3
120	Cobalt	7.56	13.5	8.23	21.4	5.95	13.5	6.62	4.99
28	Copper	817	1080	412	650	685	845	270	437
no benchmark	Iron	49300	33700	45800	25800	23500	37500	34000	21300
11	Lead	12400	9720	6620	4800	12600	11400	4700	5490
no benchmark	Magnesium	33900	14600	16800	10300	14500	15800	16400	16200
4000	Manganese	2710	2750	2340	3200	2190	2280	2270	2310
no benchmark	Mercury	14	26.5	7.3	9.27	8.42	10.8	3.73	3.27
130	Nickel	1.075	ND	22.6	1.135	23.5	1.05	0.81	ND
no benchmark	Potassium	6850	6030	3380	3250	4680	4330	2520	2830
0.63	Selenium	19.6	14.3	14.1	0.3005	ND	9.15	15.6	9.91
4.2	Silver	70.6	72.3	37.3	41.3	57.9	81.3	23.2	26.8
no benchmark	Sodium	534	387	239	3430	619	204	361	115
no benchmark	Thallium	15.8	21.6	7.12	45.7	6.08	14.1	6.62	5.9
7.8	Vanadium	20.3	30.7	3.87	14.5	18.5	14.3	3.02	8.5
46	Zinc	14900	26600	11300	29800	18000	18000	7720	14600
no benchmark	Phosphate, Total (as P)	2640	2550	2060	261	2330	1490	1360	1060

Table E-5a. (cont.)

DRAFT

	Sample ID	OU2-0-SO-45V-0.501	OU2-0-SO-46R-0.501	OU2-0-SO-46T-0.501	OU2-0-SO-46V-0	OU2-0-SO-46V-0.501	OU2-0-SO-47T-0	OU2-0-SO-47T-0.501	OU2-0-SO-48S-0
Lowest Eco-SSL TRV (mg/kg)	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
	Sample date	7/30/2015	7/30/2015	7/30/2015	7/30/2015	7/30/2015	7/30/2015	7/30/2015	7/30/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
no benchmark	Aluminum	3650	8450	3740	5310	6760	9190	15400	7330
0.27	Antimony	177	416	357	332	509	269	651	267
43	Arsenic	245	553	481	743	580	360	1010	314
2000	Barium	74.4	310	239	160	98.3	212	1360	196
21	Beryllium	0.002675	ND	0.003495	ND	0.00265	ND	0.00294	ND
0.36	Cadmium	126	66.5	71.8	62	75.8	118	126	101
no benchmark	Calcium	48000	48800	48100	40400	51300	25600	95000	52900
26	Chromium	20.9	36.9	22	26	36.4	29	69.5	27.5
120	Cobalt	2.53	12.6	9.23	7	6.94	9	15.4	9.9
28	Copper	318	698	559	278	460	494	987	387
no benchmark	Iron	9870	34900	27400	27500	26000	22700	75700	28800
11	Lead	4670	8490	6500	4220	8700	5600	15000	5920
no benchmark	Magnesium	17100	12900	13100	13900	13300	7060	40000	13700
4000	Manganese	2230	2350	5910	2300	2450	1010	4390	1950
no benchmark	Mercury	2.97	9.74	4.41	3	5.13	13	12.9	3.61
130	Nickel	0.98	1.285	ND	0.975	1	ND	2.21	ND
no benchmark	Potassium	1400	3290	1460	2210	2460	2410	7480	2740
0.63	Selenium	0.245	ND	14.2	8.84	8	20	34.6	9.49
4.2	Silver	19.5	58.9	21	22	45.1	27	82.3	28.2
no benchmark	Sodium	4.33	ND	213	4.295	ND	119	391	376
no benchmark	Thallium	0.00227	ND	9.16	7.82	4	4.31	23	21.4
7.8	Vanadium	5.99	8.47	1.98	3	8.57	13	13.2	9.21
46	Zinc	11100	14000	12200	13200	17800	19400	20200	27900
no benchmark	Phosphate, Total (as P)	418	668	1680	1670	2970	3480	3850	1240

Table E-5a. (cont.)

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	Sample ID	OU2-0-SO-48S-0.501	OU2-0-SO-48T-0	OU2-0-SO-48T-0.501	OU2-0-SO-4A-0	OU2-0-SO-4A-0.501	OU2-0-SO-50P-0	OU2-0-SO-50Q-0	OU2-0-SO-50Q-0.501
Lowest Eco-SSL TRV (mg/kg)	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
	Sample date	7/30/2015	7/30/2015	7/30/2015	9/24/2015	9/24/2015	7/29/2015	7/29/2015	7/29/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
no benchmark	Aluminum	2040	6640	9840	31200	30200	30600	7320	5700
0.27	Antimony	118	5490	441	12.4	0.1545	ND	6.6	482
43	Arsenic	685	7010	251	22.2	10.9	11.9	247	2040
2000	Barium	64.8	575	96.3	458	281	312	166	439
21	Beryllium	0.00315	ND	0.00358	ND	0.00294	ND	0.002525	ND
0.36	Cadmium	24.3	66.1	88.5	3.68	1	2.395	44.8	98.6
no benchmark	Calcium	25100	14900	58500	6170	5840	7775	50200	38000
26	Chromium	11.1	20	47	37.7	35.5	34.4	28.1	25.5
120	Cobalt	1.79	11.3	7.81	11.5	13.1	10.8	5.92	19.1
28	Copper	173	396	645	48.1	25.1	40.8	352	430
no benchmark	Iron	8560	130000	35500	26700	28100	26200	17900	74100
11	Lead	1860	3810	8380	271	18.2	160.5	4730	6640
no benchmark	Magnesium	7170	3440	21100	5670	5370	6410	11900	14900
4000	Manganese	1080	1680	2410	1070	739	765.5	1730	2330
no benchmark	Mercury	1.86	1.57	7.83	0.643	0.00073	ND	0.228	10.7
130	Nickel	1.155	ND	1.315	ND	20.1	21.6	1.1275	ND
no benchmark	Potassium	848	2310	4900	7710	6290	6555	2430	2080
0.63	Selenium	0.2885	ND	0.3275	ND	0.2695	ND	0.2315	ND
4.2	Silver	10.9	21.1	15	1.63	0.0095	ND	0.01155	ND
no benchmark	Sodium	162	335	143	487	636	710.5	242	288
no benchmark	Thallium	0.002675	ND	35.4	12.7	0.002495	ND	0.002145	ND
7.8	Vanadium	2.78	0.0825	ND	57	58.8	50.3	12.1	0.11
46	Zinc	6790	22200	15000	515	92.9	274	10400	19000
no benchmark	Phosphate, Total (as P)	1090	519	2140	1020	1040	1450	1360	1770

Table E-5a. (cont.)

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	Sample ID	OU2-0-SO-50R-0.501	OU2-0-SO-50T-0	OU2-0-SO-50T-0.501	OU2-0-SO-51P-0.501	OU2-0-SO-7C-0.501	OU2-0-SO-7F-0	OU2-0-SO-7F-0.501	OU2-0-SO-8G-0
Lowest Eco-SSL TRV (mg/kg)	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2	OU2
	Sample date	7/29/2015	7/30/2015	7/30/2015	7/29/2015	9/22/2015	9/17/2015	9/17/2015	9/17/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
no benchmark	Aluminum	4680	35800	15900	21300	25700	8860	16100	9090
0.27	Antimony	232	0.1895	ND	0.2945	490	826	1150	1270
43	Arsenic	669	11.3	3.26	8.57	449	1020	889	1060
2000	Barium	152	262	184	293	249	158	191	174
21	Beryllium	0.003245	ND	0.0031	ND	0.00482	ND	0.002665	ND
0.36	Cadmium	111	1.3	0.00855	ND	1.88	59.6	160	138
no benchmark	Calcium	48000	6300	19400	9390	22800	41900	43000	30800
26	Chromium	26.1	40.4	47.5	30.3	72.6	50.2	78.3	40.5
120	Cobalt	15.5	11.4	7.25	8.68	5.62	3.41	2.63	6.23
28	Copper	308	22.8	0.775	ND	33.9	854	1010	1770
no benchmark	Iron	48000	27300	20600	22200	23700	19600	20900	23300
11	Lead	5710	75.1	16.1	91	13000	27400	31200	28900
no benchmark	Magnesium	12200	6910	5450	5510	12600	14200	15200	9460
4000	Manganese	1930	667	142	494	1220	2740	2130	4220
no benchmark	Mercury	6.09	0.0463	0.000625	ND	0.198	6.3	16.3	54.3
130	Nickel	1.195	ND	20.9	1.105	ND	1.365	ND	79.1
no benchmark	Potassium	1510	6480	2870	6580	6810	3590	6440	2540
0.63	Selenium	14.2	0.284	ND	0.276	ND	9.2	9.53	18.2
4.2	Silver	26.3	0.0117	ND	0.01135	ND	88.7	169	193
no benchmark	Sodium	4.21	ND	520	621	633	564	327	418
no benchmark	Thallium	0.002755	ND	0.00263	ND	0.00409	ND	12.8	6.25
7.8	Vanadium	0.075	ND	60	53.3	51.7	49.7	21.6	35.1
46	Zinc	21300	122	55.3	198	9900	27900	23200	29700
no benchmark	Phosphate, Total (as P)	2030	1450	1470	1150	2290	5180	2120	1660

Table E-5a. (cont.)

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	Sample ID	OU2-0-SO-8G-0.501	OU2-0-SO-8I-0	OU2-0-SO-8I-0.501	OU2-0-SO-OP1-0-0	OU2-0-SO-OP1-0.501	OU2-0-SO-OP2-0-0	OU2-0-SO-OP2-0.501
	Depth							
	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2
Lowest Eco-SSL TRV (mg/kg)	Sample date	9/17/2015	9/21/2015	9/21/2015	7/29/2015	7/29/2015	9/17/2015	9/17/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
no benchmark	Aluminum	11100	5200	4105	11200	13400	27200	30900
0.27	Antimony	1760	257	296	244	55	8.27	0.205
43	Arsenic	1275	292	258	268	58.3	16.8	9.72
2000	Barium	278.5	57.4	40	269	241	450	386
21	Beryllium	0.0032225	ND	0.002505	ND	0.0024275	ND	0.00329
0.36	Cadmium	159	44.8	51.35	42.2	15	2	1.18
no benchmark	Calcium	20550	42900	39100	17300	14100	8500	7340
26	Chromium	47.55	28.4	25.05	23.5	25.1	31.4	33.4
120	Cobalt	8.115	2.42	1.805	3.57	4.45	11.4	9.97
28	Copper	2725	358	393	550	155	58.1	22.4
no benchmark	Iron	27250	11200	8805	19200	18500	25100	26100
11	Lead	47000	6260	5270	9960	1510	176	15.5
no benchmark	Magnesium	5955	12200	9430	5970	7430	6390	6730
4000	Manganese	4525	2110	1885	832	684	641	397
no benchmark	Mercury	201.5	5.64	2.895	7.22	5.4	0.372	0.000955
130	Nickel	1.185	ND	0.92	ND	24.4	1.015	ND
no benchmark	Potassium	2285	1820	1300	3250	3490	6060	7270
0.63	Selenium	11.55	0.2295	ND	0.2225	ND	0.253	ND
4.2	Silver	146	32.2	38.65	35.8	10.1	0.0104	ND
no benchmark	Sodium	1330	176	156	578	566	794	812
no benchmark	Thallium	0.002735	ND	0.002125	ND	0.0020625	ND	0.002345
7.8	Vanadium	34.8	11	8.855	122	47	39.6	45.7
46	Zinc	43250	12100	10235	8250	2700	272	87.2
no benchmark	Phosphate, Total (as P)	2075	1430	1385	1580	1120	883	900

Notes:

Samples were collected November 2014 to October 2015

All samples analyzed by laboratory as bulk samples.

Results reported as mg/kg

Non-detects are reported at half the detection limit

Duplicate samples have been averaged

Sampling Depth:

0 is a surface sample; collected at 0-2 inches

0.501 is taken between 6 inches and 1 foot beneath surface

Key:

ID = Identification

mg/kg = milligrams per kilogram

ND = Non-Detect

OU2 = Richardson Flat Tailings Site Operable Unit 2

SO = Soil

Table E-5b. Screening results for OU2-Upland soil samples compared with benchmarks for effects to wildlife

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	Sample ID				OU2-0-SO-12B-0.501	OU2-0-SO-12N-0.501	OU2-0-SO-140-0.501	OU2-0-SO-15D-0.501	OU2-0-SO-17F-0.501								
	Depth				0.501	0.501	0.501	0.501	0.501								
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date	Habitat	N	count of NDs	% detected	Minimum	Maximum	Average	OU2 9/22/2015 Upland	OU2 9/16/2015 Upland	OU2 9/16/2015 Upland	OU2 9/22/2015 Upland	OU2 9/22/2015 Upland				
no benchmark	Aluminum		37	0	100%	6790	48500	29070	34000	6960	23300	28900	36300				
0.27	Antimony		37	13	65%	0.147	2610	164	0.1835	ND	279	12.9	7.96	0.174	ND		
43	Arsenic		37	0	100%	6.87	799	102	8.4	ND	284	18.1	17.1	12			
2000	Barium		37	0	100%	90.3	400	273	369	191	304	351	330				
21	Beryllium		37	37	0%	0.002405	0.003265	0	0.00301	ND	0.00242	ND	0.0025	ND	0.0029	ND	
0.36	Cadmium		37	0	100%	0.916	395	30	1.47	ND	48.3	3.87	2.43	1.23			
Nutrient	Calcium		37	0	100%	1890	31000	8047	6300	31000	7480	5950	5940				
	Chromium		37	0	100%	18.6	83.7	38	33.5	ND	28.4	36.7	40.3	42.4			
	Cobalt		37	0	100%	2.82	16.7	11	13.5	ND	7.86	10.5	14.9	13.7			
	Copper		37	1	97%	14	2310	231	31.4	ND	390	43.7	31	18			
no benchmark	Iron		37	0	100%	9970	74700	26756	27400	26400	23300	26400	24700				
11	Lead		37	0	100%	13.9	32900	2625	17.3	ND	6490	218	114	29.4			
Nutrient	Magnesium		37	0	100%	1130	14000	6433	6620	14000	4840	5790	6790				
	Manganese		37	0	100%	170	2580	1073	869	2390	942	1180	1020				
no benchmark	Mercury		37	12	68%	0.0006	104	7	0.000775	ND	6.37	0.904	0.187	0.000715	ND		
130	Nickel		37	21	43%	0.89	35.9	10	1.38	ND	0.89	ND	1.33	ND	21.1		
Nutrient	Potassium		37	0	100%	1550	9460	6210	7310	2530	6170	6230	8000				
	Selenium		37	33	11%	0.2205	10.3	1	0.2755	ND	10.3	0.229	ND	0.266	ND	0.2605	ND
0.63	Silver		37	21	43%	0.00905	196	19	0.0113	ND	32.8	1.68	0.01095	ND	0.0107	ND	
Nutrient	Sodium		37	0	100%	203.5	3370	636	854	ND	228	649	932	1170			
	Thallium		37	33	11%	0.00204	4.72	0	0.002555	ND	3.73	0.00212	ND	0.002465	ND	0.002415	ND
7.8	Vanadium		37	0	100%	10.9	75.2	53	51.2	ND	21	62.1	59.4	55			
46	Zinc		37	1	97%	22.9	65300	4331	84.4	ND	9550	429	162	85.2			
no benchmark	Phosphate, Total (as P)		37	0	100%	391	1650	894	768	1620	1190	648	586				

Table E-5b. (cont.)

DRAFT

	Sample ID	OU2-0-SO-17H-0.501	OU2-0-SO-18H-0.501	OU2-0-SO-19W-0.501	OU2-0-SO-21D-0	OU2-0-SO-21D-0.501	OU2-0-SO-24I-0.501	OU2-0-SO-27I-0	OU2-0-SO-27I-0.501
	Depth	0.501	0.501	0.501	0	0.501	0.501	0	0.501
	Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU2 9/17/2015 Upland	OU2 9/17/2015 Upland	OU2 9/16/2015 Upland	OU2 9/22/2015 Upland	OU2 9/22/2015 Upland	OU2 9/15/2015 Upland	OU2 9/15/2015 Upland
no benchmark	Aluminum	27900	30200	23700	29400	32500	22100	39000	48500
0.27	Antimony	31.8	95.35	0.1545	ND	12.3	0.1505	ND	0.158
43	Arsenic	42.8	95.55	6.87	23.9	11.3	13	11.4	13.1
2000	Barium	255	276	257	289	284	358	300	400
21	Beryllium	0.00262	ND	0.0025125	ND	0.002855	ND	0.002465	ND
0.36	Cadmium	5.17	12.2	1.27	4.39	1.06	1	1.15	1.02
Nutrient	Calcium	6360	6090	4800	6870	4730	4700	5050	5690
26	Chromium	32.8	37.9	31.2	39.6	41.6	28	36.6	41
120	Cobalt	8.25	10.23	10.9	10.4	13.2	15	11.9	12.4
28	Copper	72.9	183	23.9	55.5	24	14	23.1	15.1
no benchmark	Iron	25100	23300	74700	22500	26300	23400	28400	32000
11	Lead	587	1915	19.9	359	19.4	15	32.7	23.6
Nutrient	Magnesium	5750	5670	4370	5220	5150	4950	6470	8270
4000	Manganese	759	1185	853	738	823	1730	1040	1230
no benchmark	Mercury	0.51	1.84	0.00072	ND	0.367	0.00073	ND	0.000745
130	Nickel	0.965	ND	9.1525	17.2	1.05	ND	20.1	19.2
Nutrient	Potassium	6910	7170	5550	7590	7490	4200	9210	8690
0.63	Selenium	0.24	ND	0.23	ND	0.2615	ND	0.226	ND
4.2	Silver	4.73	13.75	0.00955	ND	2.35	0.0093	ND	0.00975
Nutrient	Sodium	489	478.5	444	765	620	385	450	390
no benchmark	Thallium	0.002225	ND	0.0021325	ND	0.002425	ND	0.002095	ND
7.8	Vanadium	49.5	55.8	60.6	55.2	61.3	56	59.6	63
46	Zinc	613	1640	68.5	597	102	44	87.6	76.7
no benchmark	Phosphate, Total (as P)	1120	826	926	1250	1060	1050	590	391

Table E-5b. (cont.)

DRAFT

	Sample ID	OU2-0-SO-28L-0.501	OU2-0-SO-28N-0.501	OU2-0-SO-28P-0.501	OU2-0-SO-29F-0	OU2-0-SO-29F-0.501	OU2-0-SO-2A-0	OU2-0-SO-2A-0.501	OU2-0-SO-30H-0.501
	Depth	0.501	0.501	0.501	0	0.501	0	0.501	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU2 9/15/2015 Upland	OU2 9/15/2015 Upland	OU2 9/15/2015 Upland	OU2 9/15/2015 Upland	OU2 9/15/2015 Upland	OU2 9/22/2015 Upland	OU2 9/22/2015 Upland	OU2 9/15/2015 Upland
no benchmark	Aluminum	25100	45700	23100	31800	46200	36100	34200	39400
0.27	Antimony	0.1535	ND	5.19	123	5.3	2610	13.1	20.7
43	Arsenic	9.76		15.1	87.5	14.6	760	17.6	17.1
2000	Barium	187		290	195	316	334.5	289	320
21	Beryllium	0.002515	ND	0.00252	ND	0.002625	ND	0.00273	ND
0.36	Cadmium	1.05		6.21	51.9	2.34	1.08	40.7	3.28
Nutrient	Calcium	6270		6260	8900	6710	6265	1890	5970
26	Chromium	41		40.5	35.4	44.6	42.65	34.2	83.7
120	Cobalt	7.73		11.5	8.02	12.9	10.24	5.36	9.66
28	Copper	14.8		17.6	237	40.4	19.6	2230	42.6
no benchmark	Iron	29300		33100	24900	25400	31850	9970	31900
11	Lead	13.9		44.7	2830	171	18.15	20400	61.8
Nutrient	Magnesium	6420		7940	6110	6000	8595	1130	7810
4000	Manganese	170		880	623	1030	654.5	1770	407
no benchmark	Mercury	0.00067	ND	0.0972	2.54	0.11	0.0006925	ND	12.9
130	Nickel	0.925	ND	20.1	0.965	ND	0.0006925	ND	2.01
Nutrient	Potassium	4140		8650	5350	7650	7350	1690	9030
0.63	Selenium	0.2305	ND	0.2305	ND	0.2405	ND	0.247	ND
4.2	Silver	0.00945	ND	0.0095	ND	18.7	0.0107	ND	0.285
Nutrient	Sodium	656		443	734	652	0.25	0.0117	ND
no benchmark	Thallium	0.002135	ND	0.00214	ND	0.00223	ND	0.002315	ND
7.8	Vanadium	62.8		74	52.6	60.7	65.3	28.2	42.2
46	Zinc	65.7		701	10900	230	80	18600	1330
no benchmark	Phosphate, Total (as P)	1110		623	1340	858	449	865	912

Table E-5b. (cont.)

DRAFT

	Sample ID	OU2-0-SO-31L-0.501	OU2-0-SO-32N-0.501	OU2-0-SO-32R-0.501	OU2-0-SO-33I-0.501	OU2-0-SO-33L-0.501	OU2-0-SO-33N-0.501	OU2-0-SO-34N-0.501	OU2-0-SO-34S-0.501
	Depth	0.501	0.501	0.501	0.501	0.501	0.501	0.501	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU2 8/4/2015 Upland	OU2 8/4/2015 Upland	OU2 8/4/2015 Upland	OU2 8/5/2015 Upland	OU2 8/5/2015 Upland	OU2 8/4/2015 Upland	OU2 8/4/2015 Upland	OU2 8/4/2015 Upland
no benchmark	Aluminum	21600	28400	20500	39100	35600	33500	35800	7335
0.27	Antimony	220	65.9	0.19	ND	0.165	ND	68.8	9.34
43	Arsenic	224	71.2	20.2	8.16	10.6	66.6	16.6	674
2000	Barium	106	262	297	326	311	266	277	90
21	Beryllium	0.003245	ND	0.003025	ND	0.00274	ND	0.0027	ND
0.36	Cadmium	23.5	14.1	1.18	1.42	0.975	6.61	2.65	114
Nutrient	Calcium	10100	8620	5240	7300	6420	8010	5930	28100
26	Chromium	18.6	35.5	34.5	40.5	40.6	42.8	41	31
120	Cobalt	4.3	12.1	13.1	11.9	12.9	12.2	11.1	3
28	Copper	404	145	17.5	36.1	17.1	127	38.2	1325
no benchmark	Iron	21800	22300	24000	28300	26500	25800	26000	15000
11	Lead	3580	1310	14.2	25.4	21.3	1310	144	15900
Nutrient	Magnesium	6150	5860	5090	7940	9120	6740	6920	9410
4000	Manganese	750	1070	1250	749	797	714	881	2500
no benchmark	Mercury	4.64	1.63	0.000735	ND	0.00076	ND	1.16	0.217
130	Nickel	1.19	ND	1.11	ND	1.14	ND	22.9	29
Nutrient	Potassium	4970	6110	3300	9460	6830	7300	8520	1965
0.63	Selenium	0.2975	ND	0.277	ND	0.2845	ND	0.2475	ND
4.2	Silver	32	8.58	0.0117	ND	0.0103	ND	0.01015	ND
Nutrient	Sodium	365	374	605	745	484	565	498	204
no benchmark	Thallium	0.002755	ND	4.66	0.00264	ND	0.002325	ND	0.00229
7.8	Vanadium	46.2	48	75.2	53.9	58.6	57.9	58.1	17
46	Zinc	4360	2340	294	111	22.9	ND	1290	303
no benchmark	Phosphate, Total (as P)	1290	714	650	732	568	657	650	1455

Table E-5b. (cont.)

DRAFT

	Sample ID	OU2-0-SO-35N-0.501	OU2-0-SO-35S-0.501	OU2-0-SO-37S-0.501	OU2-0-SO-39S-0.501	OU2-0-SO-3B-0	OU2-0-SO-3B-0.501	OU2-0-SO-4B-0	OU2-0-SO-4B-0.501
	Depth	0.501	0.501	0.501	0.501	0	0.501	0	0.501
	Lowest Eco-SSL	Operable Unit	OU2	OU2	OU2	OU2	OU2	OU2	OU2
Birds/Mammals (mg/kg)	Sample date	9/14/2015	8/4/2015	8/4/2015	8/4/2015	9/24/2015	9/24/2015	9/24/2015	9/24/2015
Habitat		Upland	Upland	Upland	Upland	Upland	Upland	Upland	Upland
no benchmark	Aluminum	33600	30600	33000	29400	21500	26200	8310	6790
0.27	Antimony	9.6	32.9	184	4	18.1	0.1555	1290	123
43	Arsenic	12.7	43.2	172	13	21.9	10.7	799	103
2000	Barium	229	231	313	276	230	292	181	136
21	Beryllium	0.002535	ND	0.00254	ND	0	ND	0.0025425	ND
0.36	Cadmium	3.03	5.58	19.9	1	3.34	1.047	293	395
Nutrient	Calcium	5810	5610	7800	3950	5560	5275	15200	15300
26	Chromium	35.4	35.3	46.2	36	35.8	41.35	29.2	23.9
120	Cobalt	9.32	8.45	12.1	16	10.8	16.7	6.17	5.05
28	Copper	28.8	81.5	332	21	56.2	23	2310	18.05
no benchmark	Iron	25800	22900	24900	26600	23100	25150	28100	28900
11	Lead	64.2	644	3360	215	485	34.55	32900	3650
Nutrient	Magnesium	7510	6010	7380	6750	4310	4875	5080	3920
4000	Manganese	749	713	1350	1420	945	1379	2580	291
no benchmark	Mercury	0.0493	0.696	2.52	0	0.799	0.0872	104	71.2
130	Nickel	18.7	0.935	ND	1.2	19	0.945	ND	ND
Nutrient	Potassium	7340	6640	7710	5670	5360	5475	2090	1550
0.63	Selenium	0.232	ND	0.2325	ND	0	ND	0.23275	ND
4.2	Silver	0.00955	ND	5.02	28.9	0	0.009575	ND	ND
Nutrient	Sodium	499	340	450	350	463	438	765	792
no benchmark	Thallium	0.00215	ND	0.002155	ND	0	ND	0.0021575	ND
7.8	Vanadium	58.1	48.4	55.6	72	50.7	58.25	16.6	10.9
46	Zinc	196	695	2940	126	633	90.65	65300	8280
no benchmark	Phosphate, Total (as P)	520	651	819	638	1280	623	1650	1210

Notes:

Samples were collected November 2014 to October 2015

All samples analyzed by laboratory as bulk samples.

Results reported as mg/kg

Non-detects are reported at half the detection limit

Duplicate samples have been averaged

Sampling Depth:

0 is a surface sample; collected at 0-2 inches

0.501 is taken between 6 inches and 1 foot beneath surface

Key:

ID = Identification

mg/kg = milligrams per kilogram

ND = Non-Detect

OU2 = Richardson Flat Tailings Site Operable Unit 2

SO = Soil

Table E-5c. Screening results for OU3-Floodplain soil samples compared with benchmarks for effects to wildlife

DRAFT

Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	N	count of NDs	% detected	Minimum	Maximum	Average	OU3-0-SO-ER-10S-0	OU3-0-SO-ER-10S-0.501	OU3-0-SO-ER-12R-0	OU3-0-SO-ER-12R-0.501	OU3-0-SO-ER-1J-0.501
								0	0	0	0.501	0.501
								OU3 9/11/2015 Floodplain	OU3 9/11/2015 Floodplain	OU3 9/14/2015 Floodplain	OU3 9/14/2015 Floodplain	OU3 8/5/2015 Floodplain
no benchmark	Aluminum	149	0	100%	2.08	52200	21074	25100	26800	28100	32750	27700
0.27	Antimony	149	16	89%	0.157	1800	210	69.4	0.1605	ND	16.7	6.41
43	Arsenic	149	0	100%	0.0809	1250	192	57.1	7.57		19.5	13.5
2000	Barium	149	0	100%	2.7	871	280	293		204		26.5
21	Beryllium	149	142	5%	0.0023	0.00683	0	0.0028	ND	0.002625	ND	375.5
0.36	Cadmium	149	1	99%	0.0105	198	43	7.2	1.03	2.91	1.565	2.12
Nutrient	Calcium	149	0	100%	5.43	176000	26477	12500	6910	7330	6005	5375
26	Chromium	149	2	99%	1.195	143	39	31.9	33.7	29.4	33.95	38.4
120	Cobalt	149	0	100%	0.152	31.3	10	9.98	9.5	8.26	12.425	10.8
28	Copper	149	2	99%	0.96	3140	371	136	20.1	40.5	23.2	42.3
no benchmark	Iron	149	0	100%	4.09	97500	26712	21900	20900	24100	28550	25550
11	Lead	149	0	100%	20.6	40700	4578	1330	20.6	244	56.95	183.5
Nutrient	Magnesium	149	0	100%	2.51	36300	10045	6200	6230	5440	6295	5030
4000	Manganese	149	0	100%	6.69	15800	1788	640	414	693	1520.5	695.5
no benchmark	Mercury	149	8	95%	0.00067	2950	42	1.52	0.00079	ND	0.253	0.06555
130	Nickel	149	96	36%	0.845	28.5	7	1.03	ND	0.965	ND	15.2975
Nutrient	Potassium	149	0	100%	0.884	10100	5311	5820	6450	6810	6700	6085
0.63	Selenium	149	103	31%	0.2165	28.7	4	0.2565	ND	0.2405	ND	0.2165
4.2	Silver	149	41	72%	0.0094	175	25	13.1	0.0099	ND	2.09	0.0094
Nutrient	Sodium	149	1	99%	0.0215	2930	527	757	769	521	741	305.5
no benchmark	Thallium	149	95	36%	0.002005	36.9	4	0.002375	ND	0.002225	ND	0.002005
7.8	Vanadium	149	5	97%	0.00277	83.9	36	51.1	53.7	48.7	56.8	61.9
46	Zinc	149	1	99%	1.91	60500	7614	760	77.5	291	110.5	292.5
no benchmark	Phosphate, Total (as P)	149	0	100%	10.8	5490	1440	703	731	612	602	658

Table E-5c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-ER-2H-0.501	OU3-0-SO-ER-3M-0	OU3-0-SO-ER-3M-0.501	OU3-0-SO-ER-4D-0.501	OU3-0-SO-ER-5A-0	OU3-0-SO-ER-5A-0.501	OU3-0-SO-ER-5G-0	OU3-0-SO-ER-5G-0.501
	Depth	0.501	0	0.501	0.501	0	0.501	0	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 8/6/2015 Floodplain	OU3 9/10/2015 Floodplain						
no benchmark	Aluminum	29600	4290	27300	33700	32800	33300	20100	38700
0.27	Antimony	0.1785	ND	99.7	101	151	107	4	106
43	Arsenic	11.4	364	142	169	130	9	69.9	58.75
2000	Barium	303	350	304	315	208	273	164	348
21	Beryllium	0.00292	ND	0.00292	ND	0.002715	ND	0	ND
0.36	Cadmium	2.62	12	18.8	14	11.7	1	23.8	5.75
Nutrient	Calcium	6530	62300	8430	6220	6880	4980	18100	6810
26	Chromium	33	1.195	ND	29.8	43.5	44.3	36	27.5
120	Cobalt	13.4	26.7	9.18	9.79	9.5	12	6.1	12.25
28	Copper	35.6	67	82.1	331	245	26	251	105.35
no benchmark	Iron	24100	24600	23500	27000	24000	25400	13400	27450
11	Lead	44.2	263	925	3420	2720	31	1870	967.5
Nutrient	Magnesium	5990	3020	6360	6580	6110	6590	4950	6990
4000	Manganese	474	15800	1200	652	843	929	343	844
no benchmark	Mercury	0.0007	ND	0.325	0.34	1.71	1.83	0	ND
130	Nickel	1.07	ND	1.075	ND	20.1	17.7	21	17.9
Nutrient	Potassium	6190	1400	6070	7420	7600	6570	4250	8585
0.63	Selenium	0.2675	ND	0.2675	ND	0.249	ND	0	ND
4.2	Silver	0.011	ND	3.26	3.34	24.1	20.8	0	ND
Nutrient	Sodium	438	596	534	510	402	440	502	893
no benchmark	Thallium	0.002475	ND	7.3	0.002675	ND	0.002305	ND	0.00218
7.8	Vanadium	44	4.35	36.2	49.8	52.2	50	33.3	53.45
46	Zinc	273	10300	1980	2550	2440	113	1610	626.5
no benchmark	Phosphate, Total (as P)	600	1520	807	1100	750	376	734	687

Table E-5c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-ER-5K-0	OU3-0-SO-ER-5K-0.501	OU3-0-SO-ER-6H-0.501	OU3-0-SO-ER-7J-0	OU3-0-SO-ER-7J-0.501	OU3-0-SO-ER-7O-0.501	OU3-0-SO-FT-1B-0	OU3-0-SO-FT-1B-0.501
	Depth	0	0.501	0.501	0	0.501	0.501	0	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 9/10/2015 Floodplain	OU3 9/10/2015 Floodplain	OU3 9/10/2015 Floodplain	OU3 9/10/2015 Floodplain	OU3 9/10/2015 Floodplain	OU3 9/10/2015 Floodplain	OU3 9/28/2015 Floodplain	OU3 9/28/2015 Floodplain
no benchmark	Aluminum	35600	31300	36400	4110	36900	30300	30200	26300
0.27	Antimony	124	282	0.164	ND	13.4	7.13	13.1	53
43	Arsenic	109	275	9.18	23.3	13.4	26.7	47.5	15.8
2000	Barium	193	390	339	147	365	387	244	205
21	Beryllium	0.002515	ND	0.002555	ND	0.00326	ND	0.00316	ND
0.36	Cadmium	15	30.1	1.59	1.66	2.2	4.05	17.5	1.86
Nutrient	Calcium	12400	10800	6530	176000	8520	9090	11100	6450
26	Chromium	43.1	45.4	34.8	1.33	ND	34.6	36.6	37.9
120	Cobalt	7.62	10.9	9.49	6.07	8.89	7.37	11.8	9.21
28	Copper	226	545	33.6	27.8	36.8	38.1	131	32.4
no benchmark	Iron	26300	24500	24800	10600	25800	21000	26400	18700
11	Lead	2760	6920	54.8	128	136	185	907	58
Nutrient	Magnesium	9370	8060	6900	3480	7560	6630	7540	5470
4000	Manganese	1650	1540	845	5940	402	308	1480	1230
no benchmark	Mercury	3.19	4.06	0.0648	0.139	0.0526	0.27	14.9	3.08
130	Nickel	20.5	0.94	ND	0.985	ND	19.4	1.16	ND
Nutrient	Potassium	8180	7320	8230	1430	8410	6560	6880	6020
0.63	Selenium	0.2305	ND	0.234	ND	0.2985	ND	0.2895	ND
4.2	Silver	26.8	48.8	0.0101	ND	0.01225	ND	0.00965	ND
Nutrient	Sodium	555	799	853	420	788	775	1350	697
no benchmark	Thallium	7.01	7.49	0.00228	ND	0.002765	ND	0.00268	ND
7.8	Vanadium	51.5	52	50.8	5.69	46.7	44.3	55.1	36.8
46	Zinc	6290	5370	114	271	162	484	1430	185
no benchmark	Phosphate, Total (as P)	982	1250	880	428	630	583	1710	1320

Table E-5c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-FT-1C-0	OU3-0-SO-FT-1C-0.501	OU3-0-SO-FT-2B-0	OU3-0-SO-FT-2B-0.501 Dups ave	OU3-0-SO-FT-2C-0	OU3-0-SO-FT-2C-0.501	OU3-0-SO-FT-3C-0	OU3-0-SO-FT-3B-0.501
	Depth	0	0.501	0	0.501	0	0.501	0	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	9/25/2015	9/25/2015	9/28/2015	9/28/2015	9/25/2015	9/25/2015	10/5/2015	10/5/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
no benchmark	Aluminum	13300	4600	22100	32050	5620	4890	21700	27100
0.27	Antimony	373	358	62.3	1.99	244	379	924	7
43	Arsenic	371	399	41	13.6	231	340	372	16
2000	Barium	136	53	252	211	61.5	86	211	219
21	Beryllium	0.0023	ND	0.002525	ND	0.00306	ND	0.002665	ND
0.36	Cadmium	161	198	13.7	1.775	151	149	77.2	95
Nutrient	Calcium	54300	63600	9950	9725	81200	70700	8740	9130
26	Chromium	34.2	28.9	32.3	44.6	31.7	28.7	26.1	32
120	Cobalt	9.01	6.92	8.39	7.395	15.8	10.1	12	10
28	Copper	493	578	124	30.95	430	854	1230	46
no benchmark	Iron	35600	23100	22500	21550	63100	25900	20900	21400
11	Lead	9440	10100	1230	80.35	8030	8810	12200	150
Nutrient	Magnesium	17600	18300	5260	7880	23400	18100	4660	7240
4000	Manganese	3130	2380	862	350.5	2390	2610	3000	1080
no benchmark	Mercury	6.94	7.74	6.49	0.2295	1.76	4.14	167	2
130	Nickel	0.845	ND	0.945	ND	1.125	ND	0.945	ND
Nutrient	Potassium	3720	2050	6180	7605	2550	1750	3690	6390
0.63	Selenium	8.76	7.9	0.28	ND	0.244	ND	14.3	9.25
4.2	Silver	77.2	44.1	7.61	0.010025	ND	31.8	52.1	75.7
Nutrient	Sodium	234	165	448	671.5	193	141	655	383
no benchmark	Thallium	5.42	7.76	0.002595	ND	0.0022625	ND	4.58	0.002195
7.8	Vanadium	16.8	10.3	39.6	44.5	1.62	6.68	37.9	45
46	Zinc	30100	24800	1580	199	25200	29900	11600	3090
no benchmark	Phosphate, Total (as P)	1770	1870	1040	1011	2050	1630	1530	899

Table E-5c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-FT-3C-0	OU3-0-SO-FT-3C-0.501	OU3-0-SO-FT-3D-0	OU3-0-SO-FT-3D-0.501	OU3-0-SO-FT-4A-0	OU3-0-SO-FT-4A-0.501	OU3-0-SO-FT-4B-0	OU3-0-SO-FT-4B-0.501
	Depth	0	0.501	0	0.501	0	0501	0	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 9/25/2015 Floodplain	OU3 9/25/2015 Floodplain	OU3 9/25/2015 Floodplain	OU3 9/25/2015 Floodplain	OU3 9/28/2015 Floodplain	OU3 9/28/2015 Floodplain	OU3 9/25/2015 Floodplain	OU3 9/25/2015 Floodplain
no benchmark	Aluminum	4690	4020	38700	32200	15300	31400	9140	13600
0.27	Antimony	253	470	190	56	48.9	16.4	355	272.5
43	Arsenic	207	378	67.1	28	94.4	41.9	431	252.5
2000	Barium	83.5	45.3	417	373	411	294	633	799.5
21	Beryllium	0.002385	ND	0.002665	ND	0	ND	0.004165	ND
0.36	Cadmium	135	93.6	47.6	9	11.5	3.06	34	61.15
Nutrient	Calcium	81200	42200	7700	6990	27500	12500	41600	84550
26	Chromium	59.3	30.4	41.1	36	24.5	38.1	42.7	51.5
120	Cobalt	11	2.58	14.5	9	16.8	8.57	7.13	6.08
28	Copper	350	837	256	133	118	48.2	408	377
no benchmark	Iron	46700	13200	26800	21700	26400	28400	42700	33050
11	Lead	5050	9940	1420	805	1160	277	7940	6445
Nutrient	Magnesium	20800	11100	7110	6420	6480	8020	14600	35250
4000	Manganese	2150	1980	286	148	1790	228	1850	3715
no benchmark	Mercury	2.34	18.2	40.1	4	2.74	0.563	4.82	9.15
130	Nickel	0.875	ND	0.855	ND	2.335	ND	0.98	ND
Nutrient	Potassium	2270	1270	8550	7660	3440	7250	3230	5320
0.63	Selenium	10.9	0.244	ND	0.241	0	ND	0.3815	ND
4.2	Silver	28.3	59.5	10.8	6	7.05	0.0157	46	38.7
Nutrient	Sodium	137	150	915	825	2930	1110	265	405.5
no benchmark	Thallium	3.56	5.38	0.002235	ND	0	ND	0.003535	ND
7.8	Vanadium	3.41	8.67	62.3	50	24.1	46.6	12.3	20.3
46	Zinc	21900	23500	1970	34	ND	1540	329	4900
no benchmark	Phosphate, Total (as P)	1770	1400	1030	1130	1300	1420	1680	1520

Table E-5c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-FT-4C-0	OU3-0-SO-FT-4C-0.501	OU3-0-SO-FT-5C-0	OU3-0-SO-FT-5C-0.501	OU3-0-SO-FT-6B-0	OU3-0-SO-FT-6B-0.501	OU3-0-SO-FT-6D-0	OU3-0-SO-FT-6D-0.501
	Depth	0	0.501	0	0.501	0	0.501	0	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 9/25/2015 Floodplain	OU3 9/25/2015 Floodplain	OU3 9/25/2015 Floodplain	OU3 9/25/2015 Floodplain	OU3 9/24/2015 Floodplain	OU3 9/24/2015 Floodplain	OU3 9/25/2015 Floodplain	OU3 9/25/2015 Floodplain
no benchmark	Aluminum	4640	4050	5640	4920	52200	12600	23900	29100
0.27	Antimony	183	402	373	483	152	205	102	8.31
43	Arsenic	155	1020	463	424	129	203	34.2	25.6
2000	Barium	80.2	151	115	144	347	182	440	401
21	Beryllium	0.00258	ND	0.0024	ND	0.002575	ND	0.002735	ND
0.36	Cadmium	48.8	111	120	133	89	62.8	18.3	13.6
Nutrient	Calcium	96700	66200	53200	32100	14300	17000	11200	9490
26	Chromium	32.3	28.5	32	30.4	74	37.3	50.8	35.1
120	Cobalt	6.34	2.64	15	10.4	10	11.3	8.1	9.99
28	Copper	263	947	838	930	589	318	224	41.7
no benchmark	Iron	18900	21400	60100	37200	33700	30800	18400	19600
11	Lead	4390	11200	9750	10900	6070	5430	2580	78.4
Nutrient	Magnesium	24400	19200	16300	12500	12700	7430	7850	7330
4000	Manganese	2440	2690	2380	1710	796	1410	798	1220
no benchmark	Mercury	2.02	6.11	8.57	20.3	16	10.6	2.47	0.889
130	Nickel	0.89	ND	0.87	ND	0.945	ND	1.285	ND
Nutrient	Potassium	2300	1500	2390	2310	10100	2840	6430	7390
0.63	Selenium	0.2365	ND	0.22	ND	21.8	17.4	12	9.63
4.2	Silver	36.5	63	55.8	65.5	46	25.3	14.3	0.0148
Nutrient	Sodium	164	152	235	204	558	342	659	1010
no benchmark	Thallium	0.00219	ND	36.9	7.76	6.68	6	0.00232	ND
7.8	Vanadium	7.72	8.15	0.07	ND	4.02	84	25.8	46.3
46	Zinc	12800	25400	22300	23300	10000	9690	2780	1010
no benchmark	Phosphate, Total (as P)	1610	1050	1690	1740	1410	1690	1530	609

Table E-5c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MR1-0.501	OU3-0-SO-MR4-0.501	OU3-0-SO-MRL-15D-0	OU3-0-SO-MRL-15D-0.501	OU3-0-SO-MRL-15E-0	OU3-0-SO-MRL-15E-0.501	OU3-0-SO-MRL-16D-0	OU3-0-SO-MRL-16D-0.501
	Depth	0.501	0.501	0	0.501	0	0.501	0	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 3/2/2015 Floodplain	OU3 3/2/2015 Floodplain	OU3 9/29/2015 Floodplain	OU3 9/29/2015 Floodplain	OU3 9/29/2015 Floodplain	OU3 9/29/2015 Floodplain	OU3 9/30/2015 Floodplain	OU3 9/30/2015 Floodplain
no benchmark	Aluminum	27100	22400	34600	32000	27100	33100	40200	21900
0.27	Antimony	11.4	0.1845	ND	4.47	5.37	1460	20.1	4.27
43	Arsenic	30.6	10.8	16.1	17.5	1250	27.2	22.4	126
2000	Barium	280	207	288	281	206	248	275	208
21	Beryllium	0.003075	ND	0.003025	ND	0.002765	ND	0.00411	ND
0.36	Cadmium	3.38	1.26	1.51	1.52	99	24	1.96	41.9
Nutrient	Calcium	6370	4310	7520	7180	54000	11200	5290	18800
26	Chromium	34.6	34.6	41.5	38.4	143	40	48.3	59.6
120	Cobalt	12.6	11.9	10.9	10.6	3.31	14.4	17.6	10.4
28	Copper	74.8	22	34	34.5	1920	51.6	36.8	262
no benchmark	Iron	25800	23100	25800	23800	23200	23300	29100	33100
11	Lead	226	35.3	113	116	33000	334	191	3780
Nutrient	Magnesium	7520	5880	7080	7140	19900	9540	6510	10300
4000	Manganese	1120	945	1060	1230	2280	1890	1310	1360
no benchmark	Mercury	0.193	0.243	0.304	0.213	33	0.455	0.269	20.2
130	Nickel	1.13	ND	1.11	ND	19.9	21.3	1.51	ND
Nutrient	Potassium	7280	4940	9380	8110	9710	7770	9490	5320
0.63	Selenium	0.2815	ND	0.277	ND	0.2415	ND	0.2535	ND
4.2	Silver	2.72	0.0114	ND	0.0099	ND	0.0104	ND	175
Nutrient	Sodium	330	189	315	299	390	529	266	225
no benchmark	Thallium	0.003265	ND	0.003205	ND	0.002235	ND	0.002345	ND
7.8	Vanadium	60.5	63.9	63.6	54	67.9	43	63.4	27.7
46	Zinc	782	1140	192	186	22900	1970	336	6790
no benchmark	Phosphate, Total (as P)	1370	1630	1320	1310	4350	799	746	1310

Table E-5c. (cont.)

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	Sample ID	OU3-9-SO-MRL-16D-0.501	OU3-0-SO-MRL-16F-0	OU3-0-SO-MRL-16F-0.501	OU3-0-SO-MRL-16H-0	OU3-0-SO-MRL-16H-0.501	OU3-0-SO-MRL-18F-0	OU3-0-SO-MRU-10C-0	OU3-0-SO-MRU-10C-0.501
	Depth	0.501	0	0.501	0	0.501	0	0	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 9/30/2015 Floodplain	OU3 9/28/2015 Floodplain	OU3 9/28/2015 Floodplain	OU3 9/28/2015 Floodplain	OU3 9/28/2015 Floodplain	OU3 9/29/2015 Floodplain	OU3 10/1/2015 Floodplain	OU3 10/1/2015 Floodplain
no benchmark	Aluminum	23000	19400	28500	35800	37700	33700	15000	3760
0.27	Antimony	177	1800	1570	4.33	0.157	188	290	1100
43	Arsenic	156	1130	517	14.4	15.5	75.5	171	770
2000	Barium	238	215	248	269	329	292	303	241
21	Beryllium	0	ND	0.00291	ND	0.002655	ND	0.00257	ND
0.36	Cadmium	49	77.6	35	2.26	1.34	91.4	50.5	127
Nutrient	Calcium	19400	10600	4110	11900	7010	10500	12600	6690
26	Chromium	35	25.3	25	38.3	36.7	45.6	18.6	22.7
120	Cobalt	16	9.41	8	9.26	14	12.4	6.03	9.04
28	Copper	292	3140	2560	38.9	30.8	451	561	2080
no benchmark	Iron	38400	27100	16700	25200	27700	26300	19600	26300
11	Lead	4090	40700	18500	88.2	30.3	1790	7060	22600
Nutrient	Magnesium	10400	3590	3920	6510	6810	7070	3150	1550
4000	Manganese	1820	2740	1020	541	1660	763	1360	3620
no benchmark	Mercury	38	2950	84	0.124	0.000755	ND	58.7	8.57
130	Nickel	18	1.07	ND	1	19.6	22.3	1.4	ND
Nutrient	Potassium	5800	3230	3310	8580	8260	7040	2350	491
0.63	Selenium	8	12.3	0	ND	0.235	ND	0.349	ND
4.2	Silver	20	18.5	147	0.01	ND	0.00965	17	26.4
Nutrient	Sodium	257	1120	2130	427	358	593	559	457
no benchmark	Thallium	0	ND	0.00247	ND	0.00225	ND	0.003235	ND
7.8	Vanadium	33	39.2	31	54.3	54.5	54	26.5	7
46	Zinc	8410	26800	14900	286	145	3280	12000	60500
no benchmark	Phosphate, Total (as P)	1300	2240	1690	1430	1440	1340	1030	726

Table E-5c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRU-11C-0	OU3-0-SO-MRU-11C-0.501	OU3-0-SO-MRU-12C-0	OU3-0-SO-MRU-12C-0.501	OU3-0-SO-MRU-13C-0	OU3-0-SO-MRU-13C-0.501	OU3-0-SO-MRU-1C-0	OU3-0-SO-MRU-1C-0.501
	Depth	0	0.501	0	0.501	0	0.501	0	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 10/1/2015 Floodplain	OU3 10/1/2015 Floodplain	OU3 10/1/2015 Floodplain	OU3 10/1/2015 Floodplain	OU3 10/1/2015 Floodplain	OU3 10/1/2015 Floodplain	OU3 11/10/2014 Floodplain	OU3 11/10/2014 Floodplain
no benchmark	Aluminum	2.08	6710	7270	6160	41100	5190	17160	18300
0.27	Antimony	663	203	374	413	290	355	165.5	187
43	Arsenic	793	216	568	393	182	724	192	222
2000	Barium	654	131	68.4	156	375	220	291	472
21	Beryllium	0.003065	ND	0.00323	ND	0.002615	ND	0.002945	ND
0.36	Cadmium	148	69.1	70.4	92.9	44.6	65.9	59.1	31.7
Nutrient	Calcium	5.43	60400	42600	63600	14400	14500	18450	18000
26	Chromium	98.6	41.3	29.8	47.7	76.3	24.1	47.15	48.6
120	Cobalt	3.93	15.5	4.11	2.81	9.91	31.3	14.9	9.08
28	Copper	854	365	541	719	909	685	334.5	330
no benchmark	Iron	4.09	77300	15300	14400	28700	97500	35650	34300
11	Lead	14000	7680	8950	9670	8930	11200	4005	3760
Nutrient	Magnesium	2.51	20200	10400	17400	13700	7230	9690	9050
4000	Manganese	2790	2120	1950	3370	1510	1040	2570	1330
no benchmark	Mercury	16.4	5.49	5.28	6.92	36.4	12	2.7535	0.888
130	Nickel	1.125	ND	1.185	ND	0.96	ND	13.2725	1.33
Nutrient	Potassium	0.884	3350	2120	2250	7240	1600	5825	6490
0.63	Selenium	18.9	19.9	8.55	0.2395	ND	10.4	28.7	0.27925
4.2	Silver	85.6	28.2	45.2	51.3	77.6	36.1	30.55	34.2
Nutrient	Sodium	0.0215	190	276	111	671	200	375	264
no benchmark	Thallium	21.6	4.39	8.51	7.64	8.31	0.0025	ND	2.211325
7.8	Vanadium	0.00277	0.093	ND	21.8	10.8	72.4	0.085	ND
46	Zinc	15300	13300	19000	25900	9500	14200	5635	5170
no benchmark	Phosphate, Total (as P)	3090	3530	1530	1640	1470	1780	1990	4450

Table E-5c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRU-1D-0	OU3-0-SO-MRU-1D-0.501	OU3-0-SO-MRU-2B-0	OU3-0-SO-MRU-2B-0.501	OU3-0-SO-MRU-2C-0	OU3-0-SO-MRU-2C-0.501	OU3-0-SO-MRU-2D-0	OU3-0-SO-MRU-2D-0.501
	Depth	0	0.501	0	0.501	0	0.501	0	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 11/12/2014 Floodplain	OU3 11/12/2014 Floodplain	OU3 11/10/2014 Floodplain	OU3 11/10/2014 Floodplain	OU3 11/10/2014 Floodplain	OU3 11/10/2014 Floodplain	OU3 11/12/2014 Floodplain	OU3 11/12/2014 Floodplain
no benchmark	Aluminum	21100	23600	20900	31400	26800	20400	29000	22800
0.27	Antimony	24.3	24.6	100	0.2165	ND	40.1	345	0.1675
43	Arsenic	24.1	31.2	80	11.3	ND	51.5	297	7.23
2000	Barium	186	186	225	277	220	216	218	154
21	Beryllium	0.00298	ND	0.003605	ND	0.003165	ND	0.00298	ND
0.36	Cadmium	7.1	5.1	13	1.66	ND	31.6	76.9	2.4
Nutrient	Calcium	15000	66500	12100	9420	14400	13700	8660	83700
26	Chromium	50.6	31.4	62.7	93.5	43.8	45.2	37.1	28.6
120	Cobalt	11	9.02	7.04	10.4	10.5	9.73	15.9	9.21
28	Copper	74.7	74.4	160	24.1	144	687	31.4	0.96
no benchmark	Iron	20400	20900	18000	23300	21200	27300	30300	20400
11	Lead	660	401	2460	24.7	1250	6520	42.6	42.3
Nutrient	Magnesium	8400	9220	4120	5210	7440	6720	6620	13900
4000	Manganese	1140	3390	925	925	1490	1490	776	3460
no benchmark	Mercury	1.53	1.11	3.98	0.0612	2.77	2.21	0.00142	ND
130	Nickel	1.095	ND	1.325	ND	1.165	ND	1.265	ND
Nutrient	Potassium	7640	8150	5640	7780	6010	5300	5430	7960
0.63	Selenium	0.273	ND	0.3305	ND	0.29	ND	0.316	ND
4.2	Silver	4.59	3.08	10.4	0.01335	ND	8.87	44.8	0.01035
Nutrient	Sodium	705	1080	417	337	477	360	2190	1210
no benchmark	Thallium	0.00253	ND	0.00306	ND	0.002685	ND	0.00301	ND
7.8	Vanadium	48.9	52.9	39.8	57.2	50.3	38	83.7	47.8
46	Zinc	1230	901	1900	125	2990	15500	166	148
no benchmark	Phosphate, Total (as P)	1720	1300	3760	1930	1800	5490	927	1510

Table E-5c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRU-3C-0	OU3-0-SO-MRU-3C-0.501	OU3-0-SO-MRU-3D-0	OU3-0-SO-MRU-3D-0.501	OU3-0-SO-MRU-4C-0	OU3-0-SO-MRU-4C-0.501	OU3-0-SO-MRU-4D-0	OU3-0-SO-MRU-4D-0.501
	Depth	0	0.501	0	0.501	0	0.501	0	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 11/10/2014 Floodplain	OU3 11/10/2014 Floodplain	OU3 11/12/2014 Floodplain	OU3 11/12/2014 Floodplain	OU3 11/10/2014 Floodplain	OU3 11/11/2014 Floodplain	OU3 11/12/2014 Floodplain	OU3 11/12/2014 Floodplain
no benchmark	Aluminum	31600	28500	19600	29900	17000	20000	28450	28900
0.27	Antimony	24.7	171	0.19	8.83	0.1725	ND	139	8.1
43	Arsenic	37.5	192	7.5	17	9.02	117	15.35	55.3
2000	Barium	328	222	167	204	141	113	257.5	273
21	Beryllium	0.003015	ND	0.00347	ND	0.00384	ND	0.00282	ND
0.36	Cadmium	9.5	26.9	3.3	2.93	1.21	17.2	2.665	15.7
Nutrient	Calcium	6690	8560	14200	17700	5800	16500	5525	13400
26	Chromium	36	45.6	66.8	39.5	37.4	36.5	35.45	44.3
120	Cobalt	12.3	9.79	28.8	13.7	5.65	12.5	11	11
28	Copper	111	300	58.9	35.5	32.4	239	35.15	107
no benchmark	Iron	28100	26300	22700	31300	13200	20500	25750	24900
11	Lead	868	4230	68.2	220	27.7	3460	185	1260
Nutrient	Magnesium	6920	8210	8710	10900	3960	8920	6270	7470
4000	Manganese	879	995	576	1010	336	714	913	1470
no benchmark	Mercury	1.01	0.688	0.0804	0.489	0.00132	ND	7.52	0.295
130	Nickel	1.105	ND	1.275	ND	24.8	27.5	1.035	ND
Nutrient	Potassium	7930	9970	4380	8540	4120	4680	8775	7640
0.63	Selenium	0.276	ND	0.318	ND	0.2845	ND	0.352	ND
4.2	Silver	3.88	20.2	0.0117	ND	0.01445	ND	0.0106	ND
Nutrient	Sodium	359	462	2080	2740	457	455	385.5	478
no benchmark	Thallium	0.00256	ND	0.002945	ND	0.00264	ND	0.002395	ND
7.8	Vanadium	62.3	51.6	56.4	69.4	33.8	39	64.35	64.6
46	Zinc	1250	4620	260	540	59.7	3310	355.5	2670
no benchmark	Phosphate, Total (as P)	1260	2430	847	1140	1410	1330	1255	1810

Table E-5c. (cont.)

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	Sample ID	OU3-0-SO-MRU-5C-0	OU3-0-SO-MRU-5C-0.501	OU3-0-SO-MRU-5D-0	OU3-0-SO-MRU-5D-0.501	OU3-0-SO-MRU-6C-0	OU3-0-SO-MRU-6C-0.501	OU3-0-SO-MRU-7C-0	OU3-0-SO-MRU-7C-0.501
	Depth	0	0.501	0	0.501	0	0.501	0	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 11/11/2014 Floodplain	OU3 11/11/2014 Floodplain	OU3 11/12/2014 Floodplain	OU3 11/12/2014 Floodplain	OU3 11/11/2014 Floodplain	OU3 11/11/2014 Floodplain	OU3 9/30/2015 Floodplain	OU3 9/30/2015 Floodplain
no benchmark	Aluminum	26200	25100	26300	26800	30300	31100	23200	16900
0.27	Antimony	61.4	40.1	13.2	16.5	39.7	13.6	294	40.7
43	Arsenic	151	45.7	19.2	27.6	41.1	20.1	246	46.4
2000	Barium	318	165	258	162	191	260	245	183
21	Beryllium	0.003305	ND	0.003565	ND	0.002925	ND	0.003195	ND
0.36	Cadmium	65.1	7.78	4.88	3.87	32.3	6.38	37.6	6.18
Nutrient	Calcium	33700	56800	5600	14600	24500	14500	19300	39200
26	Chromium	47.6	105	38.4	39.5	60.2	85.9	55.7	88.9
120	Cobalt	21.9	6.78	10.9	9.23	7.95	7.06	11.5	6
28	Copper	216	88.5	46	51.2	144	38.5	505	75.2
no benchmark	Iron	27200	18300	22700	22700	21600	22800	34800	20100
11	Lead	2040	928	388	729	1120	226	7060	830
Nutrient	Magnesium	10100	27200	7220	7600	8770	5310	8870	27900
4000	Manganese	15600	1100	1170	848	1360	409	2200	960
no benchmark	Mercury	3.88	3.67	0.615	0.521	1.48	0.55	15.9	1.94
130	Nickel	40.4	1.31	ND	21.2	1.175	ND	29.8	1.51
Nutrient	Potassium	5640	6720	8920	8240	6520	7570	5080	4520
0.63	Selenium	0.303	ND	0.3265	ND	0.268	ND	0.2925	ND
4.2	Silver	16.6	3.93	1.91	3.06	9.2	0.01545	ND	47.2
Nutrient	Sodium	493	665	277	184	912	496	276	539
no benchmark	Thallium	0.002805	ND	0.003025	ND	0.002485	ND	0.00271	ND
7.8	Vanadium	46.1	52	61.2	59	51.5	57.2	67.1	59.3
46	Zinc	12500	1510	708	768	5060	1300	8100	1130
no benchmark	Phosphate, Total (as P)	2010	3930	1640	2120	3620	5340	1740	5670

Table E-5c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRU-7D-0	OU3-0-SO-MRU-7D-0.501	OU3-0-SO-MRU-8C-0	OU3-0-SO-MRU-8C-0.501	OU3-0-SO-NR-10I-0.501	OU3-0-SO-NR-11J-0	OU3-0-SO-NR-11J-0.501	OU3-0-SO-NR-13L-0
	Depth	0	0.501 Dups ave	0	0.501	0.501 Dups ave	0	0.501	0
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 10/1/2015 Floodplain	OU3 10/1/2015 Floodplain	OU3 10/1/2015 Floodplain	OU3 10/1/2015 Floodplain	OU3 9/21/2015 Floodplain	OU3 9/21/2015 Floodplain	OU3 9/21/2015 Floodplain	OU3 9/18/2015 Floodplain
no benchmark	Aluminum	46700	41050	26100	34900	30300	26700	32400	33300
0.27	Antimony	6.75	2.13075	30	6.26	8.16	2290	5.6	12
43	Arsenic	15.7	11.5	55.2	32.2	17.75	846	6.88	19
2000	Barium	369	299	364	376	352	320	317	393
21	Beryllium	0.002515	ND	0.0026825	ND	0.00266	ND	0.002875	ND
0.36	Cadmium	2.18	1.525	5.83	1.94	9.285	49.7	1.5	4.51
Nutrient	Calcium	15100	5615	21900	14600	8125	2580	8510	10800
26	Chromium	47	46.7	66.6	67.5	40	14.8	37.7	43.3
120	Cobalt	14.3	11.65	9.02	10.9	10.18	5.11	6.53	7.55
28	Copper	26.3	18.6	93.3	38.8	32.35	2200	26.1	44.2
no benchmark	Iron	32200	30600	26000	27600	24700	11100	24500	25700
11	Lead	184	93.9	837	58.5	25.6	22200	24.9	141
Nutrient	Magnesium	16800	11900	5050	6600	8595	1380	8480	7940
4000	Manganese	1590	801.5	1270	1440	1053.5	874	125	252
no benchmark	Mercury	0.344	0.2845	2.64	0.531	0.2165	676	0.215	0.274
130	Nickel	26.1	24.9	20.6	24.2	20.25	25.2	18.8	23.1
Nutrient	Potassium	16800	14150	6990	9330	7770	1800	8150	7210
0.63	Selenium	0.2305	ND	0.24575	ND	0.2435	ND	0.2455	ND
4.2	Silver	0.00945	ND	0.0101	ND	5.18	0.01	ND	ND
Nutrient	Sodium	484	468	612	473	883.5	2600	926	934
no benchmark	Thallium	0.002135	ND	0.0022775	ND	0.002215	ND	0.002255	ND
7.8	Vanadium	76.1	67.7	53	59.7	40.1	30.7	45.8	50
46	Zinc	339	218	967	191	941.5	14300	106	788
no benchmark	Phosphate, Total (as P)	1000	894	5540	4530	798	909	871	859

Table E-5c. (cont.)

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	Sample ID	OU3-0-SO-NR-13L-0.501	OU3-0-SO-NR-13M-0	OU3-0-SO-NR-13M-0.501	OU3-0-SO-NR-14M-0	OU3-0-SO-NR-14M-0.501	OU3-0-SO-NR-14P-0	OU3-0-SO-NR-14P-0.501	OU3-0-SO-NR-15M-0
	Depth	0.501	0	0.501	0	0.501	0	0.501	0
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 9/18/2015 Floodplain	OU3 9/18/2015 Floodplain	OU3 9/18/2015 Floodplain	OU3 9/18/2015 Floodplain	OU3 9/18/2015 Floodplain	OU3 9/21/2015 Floodplain	OU3 9/21/2015 Floodplain	OU3 9/17/2015 Floodplain
no benchmark	Aluminum	42600	7510	29700	7060	20700	26400	31300	9180
0.27	Antimony	11.9	600	0.1975	ND	465	1170	38.8	0.1495
43	Arsenic	35.7	568	9.93	ND	384	702	33.7	7.78
2000	Barium	436	149	227	192	256	175	197	174
21	Beryllium	0.003375	ND	0.00276	ND	0.00252	ND	0.00357	ND
0.36	Cadmium	6.04	118	3.88	51.8	106	30.7	0.948	100
Nutrient	Calcium	10900	38400	6900	26900	9840	7930	5300	33000
26	Chromium	55.6	72.8	48.6	40.5	42.2	29.1	30.2	34.5
120	Cobalt	17.3	5.63	7.43	5.99	7.57	7.2	8.02	6.38
28	Copper	45.1	950	0.835	ND	766	1750	86	20.2
no benchmark	Iron	34000	21200	15600	22100	23100	19100	21700	20300
11	Lead	138	15800	32.3	7920	25300	593	15.3	16300
Nutrient	Magnesium	9410	10100	6640	8100	5070	5790	6240	10300
4000	Manganese	767	2750	155	1560	2100	448	301	2630
no benchmark	Mercury	0.145	17.3	0.00082	ND	26.9	132	0.999	0.000765
130	Nickel	26	1.015	ND	1.185	0.925	ND	1.095	ND
Nutrient	Potassium	7840	2310	4840	1850	4310	7460	8060	2690
0.63	Selenium	0.309	ND	0.2525	ND	10.3	0.327	ND	0.224
4.2	Silver	0.0127	ND	74.2	0.01215	ND	42	83.1	4.25
Nutrient	Sodium	995	301	657	329	1130	586	650	382
no benchmark	Thallium	0.002865	ND	5.54	0.002745	ND	3.75	0.00303	ND
7.8	Vanadium	52.3	14.7	37.7	13.2	41.6	37.6	41.8	20.4
46	Zinc	572	22100	1790	12800	26400	4290	81.4	20900
no benchmark	Phosphate, Total (as P)	836	1910	665	1740	925	650	578	1560

Table E-5c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-NR-15M-0.501	OU3-0-SO-NR-15P-0	OU3-0-SO-NR-15PI-0.501	OU3-0-SO-NR-2E-0.501	OU3-0-SO-NR-3F-0	OU3-0-SO-NR-3F-0.501	OU3-0-SO-NR-4H-0.501	OU3-0-SO-NR-7I-0
	Depth	0.501	0	0.501	0.501	0	0.501	0.501	0
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 9/17/2015 Floodplain	OU3 9/21/2015 Floodplain	OU3 9/21/2015 Floodplain	OU3 9/22/2015 Floodplain	OU3 9/22/2015 Floodplain	OU3 9/22/2015 Floodplain	OU3 9/22/2015 Floodplain	OU3 9/21/2015 Floodplain
no benchmark	Aluminum	12800	5780	8360	33900	32900	36700	31800	33300
0.27	Antimony	622	343	430	0.1765	ND	106	0.1755	ND
43	Arsenic	1330	307	405	9.19	96	11	23.9	26.6
2000	Barium	230	160	223	374	282	358	412	365
21	Beryllium	0.003185	ND	0.002705	ND	0.002885	ND	0.00287	ND
0.36	Cadmium	119	40.3	67.2	2.71	31	1.27	15.6	9.75
Nutrient	Calcium	34600	27000	37800	6080	10100	7550	11600	10500
26	Chromium	38.8	23.2	43.5	39.1	45	52.1	40.2	45.3
120	Cobalt	8.92	7.99	7.04	12.3	8	7.23	7.09	10
28	Copper	963	476	676	30.9	205	25.8	46	70.2
no benchmark	Iron	27600	32900	31100	23400	25800	24000	22600	25200
11	Lead	12600	7000	8960	33.2	3060	33.2	97.9	597
Nutrient	Magnesium	12100	8770	14300	5760	7880	8470	7480	9130
4000	Manganese	2230	1450	2590	759	1070	438	204	380
no benchmark	Mercury	18.6	8.88	8.86	0.821	17	0.0945	0.989	3.11
130	Nickel	1.17	ND	0.995	ND	1.06	ND	20.9	1.345
Nutrient	Potassium	3360	1710	3120	8390	8290	7870	7580	8010
0.63	Selenium	13.1	13.4	13.2	0.2645	ND	0	0.263	ND
4.2	Silver	81.1	29.6	57	0.01085	ND	11	0.0108	ND
Nutrient	Sodium	373	213	208	622	1190	823	1700	1380
no benchmark	Thallium	6.37	3.75	7.07	0.00245	ND	0	0.002435	ND
7.8	Vanadium	26	5.91	13.6	54.9	47	45.5	64.4	45.8
46	Zinc	14900	10100	10900	1190	5240	183	769	975
no benchmark	Phosphate, Total (as P)	2220	1310	1530	832	942	635	762	1970

Table E-5c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-NR-7I-0.501	OU3-0-SO-NR-8I-0.501	OU3-0-SO-NR-9G-0.501 Dups ave	OU3-0-SO-NR-9J-0	OU3-0-SO-WR-1B-0	OU3-0-SO-WR-1B-0.501	OU3-0-SO-WR-1F-0	OU3-0-SO-WR-1F-0.501
	Depth	0.501	0.501	0.501	0	0	0.501	0	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit	OU3	OU3	OU3	OU3	OU3	OU3	OU3	OU3
	Sample date	9/21/2015	9/21/2015	9/22/2015	9/21/2015	8/4/2015	8/4/2015	7/31/2015	7/31/2015
	Habitat	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain	Floodplain
no benchmark	Aluminum	33100	10700	18750	6170	4670	3540	7670	5200
0.27	Antimony	0.169	ND	508	335.5	271	172	310	253
43	Arsenic	8.83	ND	398	333.5	297	189	370	287
2000	Barium	383	139	393.5	259	155	248	227	569
21	Beryllium	0.002765	ND	0.003135	ND	0.00296	ND	0.002605	ND
0.36	Cadmium	2.16	ND	84.6	38.35	76.4	72.6	72.7	78.7
Nutrient	Calcium	9410	19600	16900	43900	107000	39900	44900	43400
26	Chromium	47.1	ND	29.9	37.35	30.1	16.2	21	28.3
120	Cobalt	8.93	ND	3.17	6.625	52.4	5.56	6.77	8.36
28	Copper	29.4	ND	751	605	390	227	474	398
no benchmark	Iron	24800	ND	14500	20900	122000	22300	41700	40100
11	Lead	29.5	ND	13500	7565	6630	3470	7650	5550
Nutrient	Magnesium	9320	ND	6030	8300	8600	10700	14000	14100
4000	Manganese	354	ND	1480	869	1600	1710	1870	2490
no benchmark	Mercury	0.28	ND	80	5.135	11.1	2.24	7.07	3.93
130	Nickel	22	ND	1.15	1.45	1.09	ND	0.95	ND
Nutrient	Potassium	7670	ND	1980	4505	1530	1510	1360	2780
0.63	Selenium	0.2535	ND	0.287	0.28925	ND	30.9	8.9	15.1
4.2	Silver	0.0104	ND	63.7	55.35	39	16.1	47.3	29.1
Nutrient	Sodium	987	ND	386	1813.5	258	219	132	181
no benchmark	Thallium	0.002345	ND	0.00266	ND	6.0512725	0.002515	ND	48.1
7.8	Vanadium	42.6	ND	21.7	36.25	0.085	ND	6.41	1.36
46	Zinc	178	ND	18100	8135	12400	15200	12800	14600
no benchmark	Phosphate, Total (as P)	930	ND	1580	1570	2700	1520	531	1550
									1400

Table E-5c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-WR-2B-0	OU3-0-SO-WR-2B-0.501	OU3-0-SO-WR-2F-0	OU3-0-SO-WR-2F-0.501	OU3-0-SO-WR-3B-0.501	OU3-0-SO-WR-3C-0.501	OU3-0-SO-WR-3E-0.501	OU3-0-SO-WR-5B-0
	Depth	0	0.501	0	0.501	0.501	0.501	0.501	0
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 8/4/2015 Floodplain	OU3 8/4/2015 Floodplain	OU3 7/31/2015 Floodplain	OU3 7/31/2015 Floodplain	OU3 8/4/2015 Floodplain	OU3 7/31/2015 Floodplain	OU3 7/31/2015 Floodplain	OU3 8/4/2015 Floodplain
no benchmark	Aluminum	6090	6560	13100	8010	3320	10100	4670	9240
0.27	Antimony	328	343	308	281	197	443	254	207
43	Arsenic	340	404	264	576	317	435	570	191
2000	Barium	237	302	186	288	48	472	268	180
21	Beryllium	0.002325	ND	0.002805	ND	0.003325	ND	0.002565	ND
0.36	Cadmium	97.4	52.3	92.1	80.2	107	64.4	71	123
Nutrient	Calcium	50700	47400	104000	58600	57700	54700	50500	142000
26	Chromium	23.5	31.1	33.9	35.7	21	42.9	24	21.8
120	Cobalt	11.8	7.05	8.47	10.2	4.53	6.49	7	9.87
28	Copper	474	527	586	436	256	720	360	345
no benchmark	Iron	28800	34300	19200	50800	15700	44900	36600	15700
11	Lead	6370	8020	5750	5210	7220	7120	4680	5040
Nutrient	Magnesium	10900	15300	11400	20500	17000	18000	16300	9180
4000	Manganese	2690	2280	1230	2210	2760	1960	2170	1340
no benchmark	Mercury	5.75	11.1	13.3	6.86	3.35	17.4	6	5.88
130	Nickel	20.9	1.03	ND	1.295	ND	0.94	ND	1.055
Nutrient	Potassium	1820	2490	4450	3440	1160	4310	1860	2580
0.63	Selenium	13.3	12.7	0.3045	ND	17.1	0.235	ND	0.2635
4.2	Silver	28.3	41.4	34	36.3	34	54.7	31	25.3
Nutrient	Sodium	388	265	5960	318	4.155	ND	345	1180
no benchmark	Thallium	20.6	9.08	31.8	8.02	5.99	10.9	7	14.5
7.8	Vanadium	9.62	8.69	19.6	4.02	6.52	9.48	1	16.8
46	Zinc	34700	11400	26000	11500	22800	8230	14300	26500
no benchmark	Phosphate, Total (as P)	1460	607	971	2220	314	2260	1600	1220

Table E-5c. (cont.)

DRAFT

	Sample ID	OU3-0-SO-WR-5B-0.501	OU3-0-SO-WR-5F-0	OU3-0-SO-WR-5F-0.501
	Depth	0.501	0 Dups ave	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 8/4/2015 Floodplain	OU3 7/31/2015 Floodplain	OU3 7/31/2015 Floodplain
no benchmark	Aluminum	4520	4520	3590
0.27	Antimony	234	192	407
43	Arsenic	284	418	389
2000	Barium	280	54.85	106
21	Beryllium	0.002935	ND	0.00254
0.36	Cadmium	41.3	88.85	98
Nutrient	Calcium	43500	49450	62900
26	Chromium	20.8	28.8	37
120	Cobalt	8.04	3.65	5
28	Copper	333	354.5	428
no benchmark	Iron	38800	16500	12200
11	Lead	4480	3625	3320
Nutrient	Magnesium	12200	17750	17700
4000	Manganese	1570	2345	1700
no benchmark	Mercury	5.61	2.8	2
130	Nickel	1.075	ND	0.9325
Nutrient	Potassium	1570	1525	1150
0.63	Selenium	15	0.2325	ND
4.2	Silver	26.4	22	31
Nutrient	Sodium	138	252.5	135
no benchmark	Thallium	0.00249	ND	8.98
7.8	Vanadium	2.49	6.44	6
46	Zinc	8520	17950	6200
no benchmark	Phosphate, Total (as P)	363	1305	1260

Notes:

Samples were collected November 2014 to October 2015

All samples analyzed by laboratory as bulk samples.

Results reported as mg/kg

Non-detects are reported at half the detection limit

Duplicate samples have been averaged

Sampling Depth:

0 is a surface sample; collected at 0-2 inches

0.501 is taken between 6 inches and 1 foot beneath surface

Key:

ER = OU3 P.C. East Reach

ND = Non-Detect

FT = OU3 Floodplain Tailings Reach

NR = OU3 State Route 248 North Reach

ID = Identification

OU3 = Richardson Flat Tailings Site Operable Unit 3

mg/kg = milligrams per kilogram

SO = Soil

MRL = OU3 Middle Reach Lower

WR = OU3 P.C. West Reach

MR# = OU3 Middle Reach Boring Sample Collected during piezometer installation; See Figure 1-3 for piezometer location

Table E-5d. Screening results for OU3 Upland soil samples compared with benchmarks for effects to wildlife

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Table E-5d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-ER-1N-0.501	OU3-0-SO-ER-2A-0.501	OU3-0-SO-ER-2D-0.501	OU3-0-SO-ER-3C-0.501	OU3-0-SO-ER-3E-0.501	OU3-0-SO-ER-3H-0.501	OU3-0-SO-ER-4B-0	OU3-0-SO-ER-4B-0.501	OU3-0-SO-ER-4H-0.501	
	Depth	0.501	0.501	0.501	0.501 Dups ave	0.501	0.501	0	0.501	0.501	
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 8/5/2015 Upland	OU3 9/14/2015 Upland	OU3 8/6/2015 Upland	OU3 9/14/2015 Upland	OU3 8/6/2015 Upland	OU3 8/6/2015 Upland	OU3 9/14/2015 Upland	OU3 9/14/2015 Upland	OU3 9/10/2015 Upland	
no benchmark	Aluminum	27000	29300	31500	32900	32200	25400	31700	33600	35100	
0.27	Antimony	6.75	86	0.1615	ND	33	9.68	36.1	62.8	40.6	
43	Arsenic	13.3	88.3	9.86	38	19.1	43.4	80.5	49.5	23	
2000	Barium	267	277	297	274	283	209	226	291	323	
21	Beryllium	0.002525	ND	0.00257	ND	0	ND	0.002565	ND	0.00259	
0.36	Cadmium	1.93	10.2	1.23	5	2.93	4.48	10.7	8.31	2.86	
Nutrient	Calcium	5370	5560	42400	6020	5360	5430	7910	5890	7160	
26	Chromium	36.2	43.5	34.6	34	34.4	34	39.1	36.1	34.3	
120	Cobalt	11.6	13.7	8.86	10	10.2	10.6	8.91	14.2	9.46	
28	Copper	29.1	145	21.9	83	39.8	78.7	135	74.7	38.5	
no benchmark	Iron	22400	32100	23300	28000	25300	21700	24300	27900	25800	
11	Lead	75.3	1850	53.4	628	186	606	1520	738	295	
Nutrient	Magnesium	5910	5650	8390	6455	6290	4660	6220	6300	6910	
4000	Manganese	872	1460	579	823	767	335	894	1310	717	
no benchmark	Mercury	0.106	1.09	0.000725	ND	0	0.194	0.404	0.911	0.591	
130	Nickel	19.7	0.945	ND	18.2	18	18.8	0.94	ND	0.95	
Nutrient	Potassium	6470	5710	8310	6520	6350	4750	6890	6860	6480	
0.63	Selenium	0.231	ND	0.2355	ND	0	0.226	ND	0.237	ND	
4.2	Silver	0.0095	ND	13.5	0.00995	ND	5	1.65	5.11	13.7	
Nutrient	Sodium	576	420	417	576	388	442	419	483	808	
no benchmark	Thallium	0.00214	ND	0.002185	ND	0.002245	ND	0.002095	ND	0.002215	
7.8	Vanadium	56.7	80.1	46.1	67	47.9	45.9	59.6	69.4	50.4	
46	Zinc	185	1420	128	676	335	43.55	ND	1540	722	295
no benchmark	Phosphate, Total (as P)	700	584	849	525	424	997	579	536	395	

Table E-5d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-ER-4N-0.501	OU3-0-SO-ER-4Q-0	OU3-0-SO-ER-4Q-0.501	OU3-0-SO-ER-6A-0	OU3-0-SO-ER-6A-0.501	OU3-0-SO-ER-6D-0.501	OU3-0-SO-ER-6N-0.501	OU3-0-SO-ER-7P-0
	Depth	0.501	0	0.501	0	0.501	0.501	0.501	0
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 9/10/2015 Upland	OU3 8/5/2015 Upland	OU3 8/5/2015 Upland	OU3 9/14/2015 Upland	OU3 9/14/2015 Upland	OU3 9/14/2015 Upland	OU3 9/10/2015 Upland	OU3 9/10/2015 Upland
no benchmark	Aluminum	27300	26600	28500	30400	36500	35800	30600	30100
0.27	Antimony	15	20.4	8.38	4.2	0.159	ND	27.6	17.7
43	Arsenic	21.6	41.2	17.9	10.9	9.12	25.8	24.5	103
2000	Barium	281	344	230	198	258	239	325	228
21	Beryllium	0.002415	ND	0.002435	ND	0.00224	ND	0.002605	ND
0.36	Cadmium	3.01	5.15	2.17	2.26	1.11	3.07	2.85	13.6
Nutrient	Calcium	5590	6680	6430	6550	5460	6050	6200	7540
26	Chromium	40	37.1	34.9	29.8	36.3	34.8	33.3	40.5
120	Cobalt	16.3	13	10.2	9.31	12.2	8.74	10.4	7.98
28	Copper	35.8	78.6	43.4	28.1	24.2	66.2	39.8	193
no benchmark	Iron	28800	22800	23300	26900	32000	27600	24000	23200
11	Lead	199	642	214	67.5	25	433	304	2500
Nutrient	Magnesium	5300	5540	5810	5550	6620	6190	6090	6640
4000	Manganese	1220	1180	706	811	957	482	875	760
no benchmark	Mercury	0.179	0.405	0.15	0.118	0.000685	ND	0.509	0.193
130	Nickel	17.5	18.5	0.95	ND	0.82	19	0.885	2.04
Nutrient	Potassium	5260	6460	6240	7410	8080	6980	6970	7900
0.63	Selenium	0.2215	ND	0.223	ND	0.237	ND	0.2215	ND
4.2	Silver	1.56	4.13	1.52	0.00845	ND	0.0098	4.07	2.29
Nutrient	Sodium	586	432	533	508	618	610	807	586
no benchmark	Thallium	0.00205	ND	0.002065	ND	0.002195	ND	0.00221	ND
7.8	Vanadium	65.5	55.4	53	52.6	63.4	52.8	49.8	46
46	Zinc	221	661	256	286	86.7	375	264	2270
no benchmark	Phosphate, Total (as P)	693	565	904	596	554	485	490	973

Table E-5d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-ER-7P-0.501	OU3-0-SO-ER-8A-0	OU3-0-SO-ER-8A-0501	OU3-0-SO-ER-8Q-0.501	OU3-0-SO-ER-9Q-0.501 Dups ave	OU3-0-SO-FT-4E-0	OU3-0-SO-FT-4E-0.501	OU3-0-SO-FT-5E-0
	Depth	0.501	0	0501	0.501	0.501	0	0.501	0
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 9/10/2015 Upland	OU3 9/14/2015 Upland	OU3 9/14/2015 Upland	OU3 9/10/2015 Upland	OU3 9/11/2015 Upland	OU3 9/25/2015 Upland	OU3 9/25/2015 Upland	OU3 9/25/2015 Upland
no benchmark	Aluminum	30700	26800	38800	30900	28150	32500	30600	32000
0.27	Antimony	51	8.71	4.82	128	56	13.1	0.175	ND 13.5
43	Arsenic	56.9	11.1	12.7	118	59	20	16.6	19.2
2000	Barium	235	167	290	278	288	327	312	219
21	Beryllium	0.00238	ND	0.002675	ND	0.00255	ND	0.00306	ND
0.36	Cadmium	6.22	4.2	1.81	12.1	6	3.26	1.21	9.86
Nutrient	Calcium	5960	26300	7760	6310	6255	8590	5550	6040
26	Chromium	34.5	30.7	34.4	39.4	36	41.6	39.2	33.9
120	Cobalt	8	7.24	10.1	9.93	11	7.8	10.1	8.52
28	Copper	104	34.1	34.1	199	114	59.9	24.3	55.1
no benchmark	Iron	23500	22300	31200	25800	24550	22700	22800	24100
11	Lead	1050	176	104	2390	1085	375	39.5	288
Nutrient	Magnesium	6390	6730	7170	6210	5760	7170	6390	5690
4000	Manganese	603	429	771	972	959	315	380	558
no benchmark	Mercury	0.73	0.34	0.113	1.98	1	2.03	0.0903	1.54
130	Nickel	0.875	ND	0.98	ND	0.935	ND	1.125	ND
Nutrient	Potassium	7390	5660	8710	7090	5995	8010	7080	8070
0.63	Selenium	0.218	ND	0.245	ND	0.2335	ND	0.28	ND
4.2	Silver	9.67	1.78	0.00985	ND	21	10	2.14	0.0108
Nutrient	Sodium	674	368	633	721	809	445	325	347
no benchmark	Thallium	0.00202	ND	0.00227	ND	0.002165	ND	0.002595	ND
7.8	Vanadium	48.5	52.9	55.1	50	65	61.7	48.7	57.6
46	Zinc	984	659	160	1860	855	307	149	589
no benchmark	Phosphate, Total (as P)	718	711	912	649	575	1240	1070	1190

Table E-5d. (cont.)

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	Sample ID	OU3-0-SO-FT-5E-0.501	OU3-0-SO-MRL-14G-0	OU3-0-SO-MRL-14G-0.501	OU3-0-SO-MRL-14H-0	OU3-0-SO-MRL-14H-0.501	OU3-0-SO-MRL-14I-0	OU3-0-SO-MRL-14I-0.501	OU3-0-SO-MRL-14J-0
	Depth	0.501	0	0.501	0	0.501	0	0.501	0
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 9/25/2015 Upland	OU3 9/29/2015 Upland						
no benchmark	Aluminum	35600	32500	321000	31300	35400	36000	42900	28000
0.27	Antimony	0	ND	21.7	41.4	9.51	4.93	40.7	29.7
43	Arsenic	17		24.2	152	24.5	16.7	43.4	92.5
2000	Barium	249		200	3620	220	315	195	196
21	Beryllium	0	ND	0.00284	0.02155	ND	0.00273	ND	0.00335
0.36	Cadmium	1		5.44	12.2	3.3	1.84	8.24	6.01
Nutrient	Calcium	6105		9880	57800	8790	8050	43800	5980
26	Chromium	41		39.6	367	39.1	40.1	72.5	48.9
120	Cobalt	11		7.44	117	9.4	10.1	10.1	14.2
28	Copper	31		66.5	266	44.2	33.8	116	56.7
no benchmark	Iron	28300		24300	255000	24000	26100	24800	34200
11	Lead	35		459	422	213	100	1290	804
Nutrient	Magnesium	6285		6940	61500	6840	7600	9380	7940
4000	Manganese	598		410	12800	484	764	759	1740
no benchmark	Mercury	0		0.651	1.49	0.352	0.18	2.49	0.608
130	Nickel	20		1.045	ND	220	18.9	20	33.6
Nutrient	Potassium	7685		8240	75600	7250	8150	7600	8660
0.63	Selenium	0	ND	0.26	ND	1.975	ND	0.307	ND
4.2	Silver	0	ND	4.44	0.081	ND	1.73	0.0105	ND
Nutrient	Sodium	364		376	3840	352	382	434	290
no benchmark	Thallium	0	ND	0.00241	ND	0.0183	ND	0.002315	ND
7.8	Vanadium	60		57.8	596	55.1	59.2	65.7	75.6
46	Zinc	128		1120	1330	522	215	2170	1960
no benchmark	Phosphate, Total (as P)	1295		1200	12100	1090	1140	843	791
									880

Table E-5d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRL-14J-0.501	OU3-0-SO-MRL-15G-0.501	OU3-0-SO-MRL-15G-0.501	OU3-0-SO-MRL-15H-0.501	OU3-0-SO-MRL-15H-0.501 Dups ave	OU3-0-SO-MRL-15I-0.501	OU3-0-SO-MRL-15I-0.501	OU3-0-SO-MRL-15J-0.501
	Depth	0.501	0	0.501	0	0.501	0	0.501	0
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 9/29/2015 Upland	OU3 9/29/2015 Upland	OU3 9/29/2015 Upland	OU3 9/29/2015 Upland	OU3 9/29/2015 Upland	OU3 9/29/2015 Upland	OU3 9/29/2015 Upland	OU3 9/29/2015 Upland
no benchmark	Aluminum	36600	30000	34300	35000	32950	33200	36300	40800
0.27	Antimony	0.1585	ND	3.9	0.1605	ND	7.87	51.5	0.181
43	Arsenic	12.3	12.7	14	21.9	12	62	11.7	223
2000	Barium	332	204	308	238	295	237	289	197
21	Beryllium	0.002595	ND	0.002805	ND	0.00263	ND	0.00256	ND
0.36	Cadmium	0.93	1.64	1.29	3.51	1	9.64	1.2	27.5
Nutrient	Calcium	5070	7350	6130	8170	5195	9420	6350	13900
26	Chromium	41.5	69.9	40.3	39.7	39	45	47.5	57.7
120	Cobalt	14	7.73	12.5	9.1	11	12.4	11.8	8.14
28	Copper	18.7	31.8	22.2	41.9	26	126	21.2	522
no benchmark	Iron	29300	22300	25800	25400	25550	23800	24600	30100
11	Lead	27	83.1	38.9	146	23	1210	38.3	6640
Nutrient	Magnesium	6540	6050	6520	6560	5870	6830	6760	10800
4000	Manganese	1180	252	1090	706	932	1960	940	684
no benchmark	Mercury	0.00067	ND	0.154	0.0394	0.291	0	ND	0.051
130	Nickel	22.8	29.9	20.6	19	22	22.9	26.2	1.25
Nutrient	Potassium	8540	7240	7650	8320	7715	7260	7670	9330
0.63	Selenium	0.238	ND	0.257	ND	0.241	ND	0.2895	ND
4.2	Silver	0.0098	ND	0.01055	ND	0.0099	ND	9.07	0.01115
Nutrient	Sodium	333	312	348	406	398	591	422	571
no benchmark	Thallium	0.002205	ND	0.00238	ND	0.00223	ND	0.002175	ND
7.8	Vanadium	68.2	53.6	63.3	60.8	63	65.3	61	76.7
46	Zinc	73.8	203	117	426	108	1660	115	7800
no benchmark	Phosphate, Total (as P)	738	1130	919	770	811	874	546	1520

Table E-5d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRL-15J-0.501	OU3-0-SO-MRL-15K-0	OU3-0-SO-MRL-15K-0.501	OU3-0-SO-MRL-16G-0	OU3-0-SO-MRL-16G-0.501	OU3-0-SO-MRL-16I-0	OU3-0-SO-MRL-16I-0.501	OU3-0-SO-MRL-16J-0
	Depth	0.501	0	0.501	0	0.501	0	0.501	0
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 9/29/2015 Upland	OU3 9/29/2015 Upland	OU3 9/29/2015 Upland	OU3 9/28/2015 Upland	OU3 9/28/2015 Upland	OU3 9/28/2015 Upland	OU3 9/28/2015 Upland	OU3 9/28/2015 Upland
no benchmark	Aluminum	34400	29000	38200	33700	34900	36000	35800	35500
0.27	Antimony	49.6	0.165	ND	12.9	3.91	37.7	0.165	ND
43	Arsenic	29.5	11	10.2	18.8	14	41.8	13.5	25.1
2000	Barium	309	286	284	216	314	197	325	241
21	Beryllium	0.002945	ND	0.002705	ND	0.00281	ND	0.002585	ND
0.36	Cadmium	17.4	1.42	0.942	2.33	1.72	6.03	1.12	4.32
Nutrient	Calcium	6090	5900	5330	8400	5950	7790	5420	7500
26	Chromium	49.5	46.2	44.5	34.2	34.7	39.7	37.8	41
120	Cobalt	10.8	11.9	12.5	9.83	13.2	8.31	15.4	8.48
28	Copper	83.1	34.4	16.9	48.9	30.9	94.9	22.7	54
no benchmark	Iron	26800	24900	31400	23700	24500	24900	26100	27400
11	Lead	405	94.3	19.7	209	60	1010	32.4	256
Nutrient	Magnesium	5810	5210	6990	6290	6120	6940	6310	6250
4000	Manganese	955	1020	844	657	1540	424	1380	430
no benchmark	Mercury	1.17	0.0952	0.000645	ND	0.235	0.000685	ND	1.03
130	Nickel	22.5	23.4	22.2	18.4	21	19.1	21.1	19.3
Nutrient	Potassium	7260	8090	7580	8060	7480	8270	7800	7440
0.63	Selenium	0.27	ND	0.2475	ND	0.2475	ND	0.259	ND
4.2	Silver	2.64	0.0102	ND	0.01055	ND	0.00975	ND	7.26
Nutrient	Sodium	458	527	665	353	359	339	350	488
no benchmark	Thallium	0.0025	ND	0.002295	ND	0.002385	ND	0.00229	ND
7.8	Vanadium	63.6	58.5	70.9	47.3	53.7	52.4	56.3	61.7
46	Zinc	2890	148	76.6	407	173	1330	92.6	622
no benchmark	Phosphate, Total (as P)	748	975	556	1740	804	816	796	567

Table E-5d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRL-16J-0.501	OU3-0-SO-MRL-16K-0	OU3-0-SO-MRL-16K-0.501	OU3-0-SO-MRL-17G-0	OU3-0-SO-MRL-17G-0.501	OU3-0-SO-MRL-17H-0	OU3-0-SO-MRL-17H-0.501	OU3-0-SO-MRL-18G-0
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	Depth Dups ave OU3 9/28/2015 Upland	0.501 0 OU3 9/29/2015 Upland	0.501 Dups ave OU3 9/29/2015 Upland	0 OU3 9/29/2015 Upland	0.501 OU3 9/29/2015 Upland	0 OU3 9/29/2015 Upland	0.501 OU3 9/29/2015 Upland	0 OU3 9/29/2015 Upland
no benchmark	Aluminum	30000	38900	34300	33000	29200	35400	31900	34500
0.27	Antimony	0	ND	77.3	60	4.09	ND	4.12	0.157
43	Arsenic	15	ND	75.1	62	17.1	ND	18	14.7
2000	Barium	273	335	256	201	246	267	243	332
21	Beryllium	0	ND	0.002985	0	ND	0.00254	0.0027	0.00257
0.36	Cadmium	1	ND	12.2	11	2.23	ND	1.63	ND
Nutrient	Calcium	5060	18100	11850	10700	5340	6820	5260	8060
26	Chromium	41	ND	42.9	37	33.6	ND	33.9	31.1
120	Cobalt	16	12.3	12	9.42	11	12.6	12.2	11.3
28	Copper	9	ND	165	135	34	ND	34.4	24.6
no benchmark	Iron	32050	27400	26400	24700	23500	28700	26400	28300
11	Lead	25	ND	1710	1385	83.8	ND	83.9	31.1
Nutrient	Magnesium	8635	8370	7485	6200	5330	5760	5370	7010
4000	Manganese	1388	1550	1190	556	956	921	1090	1090
no benchmark	Mercury	0	ND	3.2	3	0.141	ND	0.122	0.00068
130	Nickel	27	21.6	20	1.02	ND	21.2	21.7	23
Nutrient	Potassium	4850	8540	6865	7140	6010	6890	5940	8940
0.63	Selenium	0	ND	0.2735	0	ND	0.233	ND	0.247
4.2	Silver	0	ND	15	11	0.01045	ND	0.00955	ND
Nutrient	Sodium	305	460	351	337	294	271	253	483
no benchmark	Thallium	0	ND	0.002535	0	ND	0.002155	ND	0.00229
7.8	Vanadium	64	ND	77.4	71	67.5	ND	66.1	75.5
46	Zinc	81	ND	2610	2035	341	ND	104	186
no benchmark	Phosphate, Total (as P)	687	1080	804	1020	997	1090	811	1450

Table E-5d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRL-18G-0.501	OU3-0-SO-MRL-19G-0	OU3-0-SO-MRL-19G-0.501	OU3-0-SO-MRU-10B-0	OU3-0-SO-MRU-10B-0.501	OU3-0-SO-MRU-12B-0	OU3-0-SO-MRU-12B-0.501	OU3-0-SO-MRU-12E-0
	Depth	0.501	0	0.501	0	0.501	0	0.501	0
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 9/29/2015 Upland	OU3 9/29/2015 Upland	OU3 9/29/2015 Upland	OU3 9/30/2015 Upland	OU3 9/30/2015 Upland	OU3 9/30/2015 Upland	OU3 9/30/2015 Upland	OU3 10/1/2015 Upland
no benchmark	Aluminum	34800	40200	44400	27100	29700	26600	3450	28600
0.27	Antimony	0.165	ND	0.16	ND	12.9	22.1	267	6.68
43	Arsenic	19.4		19.9	30.4	22.6	10.5	39.3	
2000	Barium	205		306	230	331	318	609	289
21	Beryllium	0.002695	ND	0.002615	ND	1.86	0.002715	ND	
0.36	Cadmium	0.89		1.8	1.57	4.01	1.13	11	98.3
Nutrient	Calcium	7390		6760	5280	6630	5240	15100	23200
26	Chromium	41.2		40.1	66.5	32.6	33.1	45.7	12000
120	Cobalt	11.2		14.2	12.7	13.3	12.7	8.71	18.3
28	Copper	34.3		34.8	25.3	60	28.1	294	0.0765
no benchmark	Iron	26400		29100	32100	27500	28600	36400	59100
11	Lead	45.7		83.2	41.9	247	55.2	925	22300
Nutrient	Magnesium	7160		6690	8250	4520	4170	6120	481
4000	Manganese	753		1310	1070	838	752	662	88.2
no benchmark	Mercury	0.127		0.0913	0.00078	ND	0.712	0.0445	5.11
130	Nickel	20.9		22.2	29.9	19.8	19.5	1.08	0.211
Nutrient	Potassium	8710		9550	9060	6600	6920	6550	3050
0.63	Selenium	0.247	ND	0.2395	ND	0.2485	ND	0.2165	8800
4.2	Silver	0.01015	ND	0.00985	ND	0.0102	ND	0.0089	0.0114
Nutrient	Sodium	369		388	353	294	263	2310	385
no benchmark	Thallium	0.00229	ND	0.00222	ND	0.002305	ND	0.002005	0.002565
7.8	Vanadium	62.7		69.6	84.4	68.3	70.8	46.5	ND
46	Zinc	144		192	118	861	190	1940	15900
no benchmark	Phosphate, Total (as P)	1500		1030	1030	1240	1180	625	97.7
									3340

Table E-5d. (cont.)

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	Sample ID	OU3-0-SO-MRU-12E-0.501	OU3-0-SO-MRU-13B-0	OU3-0-SO-MRU-13B-0.501	OU3-0-SO-MRU-1B-0	OU3-0-SO-MRU-1B-0.5-1	OU3-0-SO-MRU-3A-0	OU3-0-SO-MRU-3A-0.501	OU3-0-SO-MRU-3B-0
	Depth	0.501	0	0.501	0	0.5-1	0	0.501	0
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 10/1/2015 Upland	OU3 9/30/2015 Upland	OU3 9/30/2015 Upland	OU3 11/10/2014 Upland	OU3 11/10/2014 Upland	OU3 11/10/2014 Upland	OU3 11/10/2014 Upland	OU3 11/10/2014 Upland
no benchmark	Aluminum	30500	37600	35500	18300	25500	28100	36900	24200
0.27	Antimony	37	24	0.1645	ND	37.3	29	0.2235	ND
43	Arsenic	48.8	37.5	20.2	42	13.4	33.9	10.8	98.7
2000	Barium	287	460	574	200	301	261	285	302
21	Beryllium	0.00263	0.00283	ND	0.00269	ND	0.003125	ND	0.003235
0.36	Cadmium	8.69	4.53	0.0076	ND	10.9	2.97	6.67	1.23
Nutrient	Calcium	7620	5630	4220	10700	15900	15200	22700	13100
26	Chromium	40.5	30.8	29	72.1	124	91	117	73.7
120	Cobalt	11.2	11	18.6	6.9	9.92	8.54	9.73	10.6
28	Copper	90	62	20.9	89.3	27.1	97.3	39.9	210
no benchmark	Iron	26400	28600	29300	15800	17100	21100	25200	20600
11	Lead	1150	702	47.4	1170	49.1	914	16.5	3040
Nutrient	Magnesium	6410	4480	3690	3480	4050	5630	6750	4620
4000	Manganese	1160	1070	1490	788	929	1090	1010	1850
no benchmark	Mercury	1.29	1.33	0.0886	0.712	0.106	1.15	0.00177	ND
130	Nickel	18.7	1.04	ND	18.3	1.15	ND	29.1	22.8
Nutrient	Potassium	7120	8580	7550	5060	6330	8660	10900	6640
0.63	Selenium	0.2405	ND	0.2595	ND	0.2465	ND	0.2865	ND
4.2	Silver	5.96	2.96	0.0101	ND	6.53	0.01345	ND	13.9
Nutrient	Sodium	275	224	214	352	4.625	ND	452	416
no benchmark	Thallium	0.00223	ND	0.0024	ND	0.00228	ND	0.002655	ND
7.8	Vanadium	55.3	62.8	66.6	37.9	0.082	ND	51.4	49.3
46	Zinc	1810	993	101	1380	0.1145	ND	994	2260
no benchmark	Phosphate, Total (as P)	1340	1100	1070	4020	4870	5460	1750	4170

Table E-5d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRU-3B-0.501	OU3-0-SO-MRU-4A-0	OU3-0-SO-MRU-4A-0.501	OU3-0-SO-MRU-4B-0	OU3-0-SO-MRU-4B-0.501	OU3-0-SO-MRU-5B-0	OU3-0-SO-MRU-5B-0.501	OU3-0-SO-MRU-6A-0
	Depth	0.501	0	0.501	0	0.501	0	0.501	0
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 11/10/2014 Upland	OU3 11/10/2014 Upland	OU3 11/10/2014 Upland	OU3 11/10/2014 Upland	OU3 11/10/2014 Upland	OU3 11/11/2014 Upland	OU3 11/11/2014 Upland	OU3 11/11/2014 Upland
no benchmark	Aluminum	32700	30000	36600	17100	37400	12700	9910	20900
0.27	Antimony	11.7	8.16	4.58	61.7	13.9	23.4	23.9	14.3
43	Arsenic	19.5	16.8	16.3	42.8	19.9	26.6	30.2	22
2000	Barium	319	253	269	228	321	181	286	256
21	Beryllium	0.0036	ND	0.003115	ND	0.003295	ND	0.00314	ND
0.36	Cadmium	1.76	2.94	2.1	14.1	2.86	9.99	33.8	3.47
Nutrient	Calcium	12700	21400	19300	17300	12400	13900	15600	27600
26	Chromium	94.2	74.5	89.1	40.1	91	17.6	1.985	ND
120	Cobalt	9.86	10.8	10.7	6.11	11.8	3.56	3.51	7.88
28	Copper	40.6	76.1	91.9	152	107	74.4	95.3	37
no benchmark	Iron	23200	26300	26800	14100	25200	11600	17900	18800
11	Lead	83.6	213	108	1600	316	744	764	371
Nutrient	Magnesium	5590	6020	6680	4010	6350	2750	1870	6710
4000	Manganese	977	1590	1450	984	1460	269	542	956
no benchmark	Mercury	0.36	0.306	0.153	2.54	1.33	0.783	1.21	0.606
130	Nickel	25.1	23.9	26.4	1.155	ND	28.1	1.235	ND
Nutrient	Potassium	8830	8930	11000	5740	11900	2190	1320	5940
0.63	Selenium	0.3295	ND	0.2855	ND	0.3015	ND	0.288	ND
4.2	Silver	0.01355	ND	0.0117	ND	0.0124	ND	6.9	0.0135
Nutrient	Sodium	465	424	420	330	467	697	2.92	2.88
no benchmark	Thallium	0.003055	ND	0.002645	ND	0.002795	ND	0.002665	ND
7.8	Vanadium	58.8	55.1	63.5	33.6	66.9	20.7	16.1	43.5
46	Zinc	216	424	269	1150	366	1610	7640	468
no benchmark	Phosphate, Total (as P)	6510	68400	5100	1900	7710	1200	740	2680

Table E-5d. (cont.)

DRAFT

	Sample ID	OU3-0-SO-MRU-6A-0.501	OU3-0-SO-MRU-6B-0	OU3-0-SO-MRU-6B-0.501	OU3-0-SO-MRU-6D-0	OU3-0-SO-MRU-6D-0.501	OU3-0-SO-MRU-7B-0	OU3-0-SO-MRU-7B-0.501	OU3-0-SO-MRU-8B-0
	Depth	0.501	0	0.501	0	0.501	0	0.501	0
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 11/11/2014 Upland	OU3 11/11/2014 Upland	OU3 11/11/2014 Upland	OU3 11/12/2014 Upland	OU3 11/12/2014 Upland	OU3 9/30/2015 Upland	OU3 9/30/2015 Upland	OU3 9/30/2015 Upland
no benchmark	Aluminum	29500	14900	13600	22100	27500	17700	33900	25400
0.27	Antimony	0.221	ND	0.2435	5.01	16.7	94.1	28.5	3.98
43	Arsenic	12.9		5.55	15.7	24.3	88.9	31.7	12.2
2000	Barium	365		164	263	207	209	154	406
21	Beryllium	0.003615	ND	0.003985	0.003495	0.00284	0.00324	0.00243	0.002625
0.36	Cadmium	1.72		0.0113	1.83	7.88	23.8	5.59	1.16
Nutrient	Calcium	28100		16300	32300	11200	19000	64300	8980
26	Chromium	108		28.8	54.4	29.4	40.3	24.3	47.1
120	Cobalt	9.23		5.05	5.5	9.16	13	5.87	10.1
28	Copper	28.8		1.025	ND	20.6	48	168	64.1
no benchmark	Iron	25400		12100	12900	19400	25200	16600	25200
11	Lead	91.7		21.4	117	511	2450	906	81.1
Nutrient	Magnesium	6090		7610	14100	8320	11300	5550	4510
4000	Manganese	1280		354	684	1480	777	2810	824
no benchmark	Mercury	0.296		0.00175	ND	0.183	0.815	3.8	0.993
130	Nickel	26.5		1.465	ND	1.285	ND	24.8	0.238
Nutrient	Potassium	7460		3360	3630	7360	10200	4750	9300
0.63	Selenium	0.331	ND	0.365	ND	0.3205	ND	0.2965	ND
4.2	Silver	0.0136	ND	0.015	ND	0.01315	ND	12.4	0.895
Nutrient	Sodium	634		212	262	242	327	295	ND
no benchmark	Thallium	0.00307	ND	0.00338	ND	0.00297	ND	0.00275	ND
7.8	Vanadium	62		30.9	32.2	49	70.4	41	68.5
46	Zinc	187		67.4	241	1130	4360	908	127
no benchmark	Phosphate, Total (as P)	13800		436	2960	1010	1010	2230	1090
									1710

Table E-5d. (cont.)

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	Sample ID	OU3-0-SO-MRU-8B-0.501	OU3-0-SO-MRU-8D-0	OU3-0-SO-MRU-8D-0.501	OU3-0-SO-MRU-9B-0	OU3-0-SO-NR-11M-0.501	OU3-0-SO-NR-12Q-0	OU3-0-SO-NR-12Q-0.501	OU3-0-SO-NR-15K-0.501
	Depth	0.501	0	0.501	0	0.501	0	0.501	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 9/30/2015 Upland	OU3 10/1/2015 Upland	OU3 10/1/2015 Upland	OU3 9/30/2015 Upland	OU3 9/21/2015 Upland	OU3 10/5/2015 Upland	OU3 10/5/2015 Upland	OU3 9/17/2015 Upland
no benchmark	Aluminum	5290	35400	31000	29100	29100	17300	37900	30600
0.27	Antimony	268	8.23	0.1525	ND	21.5	0.162	ND	0.152
43	Arsenic	265	18.3	18.6	34.3	8.82	8.36	8.53	23.2
2000	Barium	305	228	236	221	219	105	150	273
21	Beryllium	0.00291	ND	0.003265	ND	0.00262	ND	0.002685	ND
0.36	Cadmium	42.7	2.68	0.906	5.05	1.67	0.833	0.002485	0.002595
Nutrient	Calcium	4350	13500	11800	5800	3890	2700	4000	6270
26	Chromium	29.9	43.7	40.2	41	29.3	20.2	33.3	34.5
120	Cobalt	5.46	14.4	12.1	15.7	8.58	6.05	8.29	10.7
28	Copper	138	35.9	20.5	51.8	27.3	17.1	0.64	55.2
no benchmark	Iron	94700	30700	30900	32500	18800	13100	24300	26100
11	Lead	6140	217	68	495	26.4	42.4	14.7	269
Nutrient	Magnesium	2210	11100	9490	6200	4390	3110	8060	5860
4000	Manganese	213	1060	1140	965	633	382	291	730
no benchmark	Mercury	10.3	ND	0.284	0.139	1.02	0.239	0.162	0.000725
130	Nickel	1.07	ND	24.7	24.4	23.4	0.975	ND	0.294
Nutrient	Potassium	1630	ND	5010	4840	5070	9190	4800	6970
0.63	Selenium	29.3	ND	0.299	0.229	0.24	0.243	ND	0.2375
4.2	Silver	36.8	ND	0.0123	0.0094	3.15	0.01	ND	2.58
Nutrient	Sodium	400	ND	747	840	238	392	293	591
no benchmark	Thallium	0.00247	ND	0.00277	ND	0.00212	ND	0.00225	ND
7.8	Vanadium	35	ND	68.2	58	79.6	40.6	33.6	51
46	Zinc	7090	ND	402	132	971	97.8	60.1	46.9
no benchmark	Phosphate, Total (as P)	1660	1240	1260	1290	637	291	264	828

Table E-5d. (cont.)

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	Sample ID	OU3-0-SO-NR-16K-0.501	OU3-0-SO-NR-2C-0	OU3-0-SO-NR-2C-0.501	OU3-0-SO-NR-2F-0	OU3-0-SO-NR-2F-0.501	OU3-0-SO-NR-4J-0	OU3-0-SO-NR-4J-0.501	OU3-0-SO-NR-9K-0.501
	Depth	0.501	0	0.501	0	0.501	0	0.501	0.501
Lowest Eco-SSL Birds/Mammals (mg/kg)	Operable Unit Sample date Habitat	OU3 9/17/2015 Upland	OU3 9/22/2015 Upland	OU3 9/22/2015 Upland	OU3 9/22/2015 Upland	OU3 9/22/2015 Upland	OU3 9/22/2015 Upland	OU3 9/22/2015 Upland	OU3 9/24/2015 Upland
no benchmark	Aluminum	23400	20900	26900	24400	30600	30500	28400	38200
0.27	Antimony	179	7.28	0.166	ND	7.25	0.1645	ND	0.161
43	Arsenic	233		10.9	6.32	13.9	8	47.2	6.94
2000	Barium	286		348	393	241	163	234	219
21	Beryllium	0.002765	ND	0.002525	ND	0.00272	ND	0.00269	376
0.36	Cadmium	21.7		3.07	1.28	2.67	0.0076	ND	0.00237
Nutrient	Calcium	23400	8660	8900	8800	3970	7330	5760	6000
26	Chromium	39.2		32.2	37.2	32.3	32.2	42.4	42.1
120	Cobalt	9.34		10.9	13.4	8.13	6.89	9.73	9.3
28	Copper	331		43	30	34.7	0.695	ND	14.3
no benchmark	Iron	27500	25200	30300	19700	19400	24500	24600	18800
11	Lead	3650		251	18.9	233	16.5	77.4	31.9
Nutrient	Magnesium	12200	5270	5900	5850	5010	7550	6590	4360
4000	Manganese	1600		706	881	472	276	318	853
no benchmark	Mercury	4.42		0.263	0.0946	0.322	0.00071	ND	0.0772
130	Nickel	1.27	ND	17.3	1	ND	0.92	ND	0.0608
Nutrient	Potassium	5030		5050	6450	5740	6070	7030	5090
0.63	Selenium	0.253	ND	0.2315	ND	0.249	ND	0.2465	ND
4.2	Silver	38		1.57	0.01025	ND	1.37	0.01015	ND
Nutrient	Sodium	626		1670	1710	459	270	526	443
no benchmark	Thallium	9.14	0.002145	ND	0.002305	ND	0.00212	ND	0.002235
7.8	Vanadium	50.6		60.6	72.1	45.1	40.9	83.8	74.2
46	Zinc	4700		333	83.6	348	55.9	104	81.5
no benchmark	Phosphate, Total (as P)	1610	1420	1250	983	605	1060	962	1260

Notes:

Samples were collected November 2014 to October 2015

All samples analyzed by laboratory as bulk samples.

Results reported as mg/kg

Non-detects are reported at half the detection limit

Duplicate samples have been averaged

Sampling Depth:

0 is a surface sample; collected at 0-2 inches

0.501 is taken between 6 inches and 1 foot beneath surface

Key:

ER = OU3 P.C. East Reach

FT = OU3 Floodplain Tailings Reach

ID = Identification

mg/kg = milligrams per kilogram

MR# = OU3 Middle Reach Boring Sample Collected during piezometer installation; See Figure 1-3 for piezometer location

MRL = OU3 Middle Reach Lower

MRU = OU3 Middle Reach Upper

ND = Non-Detect

NR = OU3 State Route 248 North Reach

OU3 = Richardson Flat Tailings Site Operable Unit 3

SO = Soil

WR = OU3 P.C. West Reach

Attachment E1

U.S. EPA Region 8

Selection of Toxicity Benchmarks for Ecological Receptors

APPENDIX C

Selection of Toxicity Benchmarks for Ecological Receptors

Overview

The hazard quotient approach to risk characterization is based on comparison of site-related indices of exposure to appropriate benchmarks of toxicity. These benchmarks may be concentration-based (e.g., the concentration in soil, sediment, surface water, tissue, or diet), or may be dose-based (e.g., mg/kg body weight/day). Each benchmark is contaminant-specific, receptor-specific, and is usually medium-specific.

All toxicity benchmarks are based on values developed by various regulatory agencies and published in the literature. This appendix describes the various sources of benchmark values, identifies the hierarchy used to prioritize values when more than one value was available, and summarizes the selected values.

This appendix is organized into the following sections:

Aquatic Receptors (Fish & Benthic Macroinvertebrates)

- C-1 Benchmarks for Direct Contact with Surface Water
- C-2 Benchmarks for Direct Contact with Sediment
- C-3 Oral Toxicity Benchmarks for Fish
- C-4 Tissue-based Benchmarks

Amphibians

- C-5 Benchmarks for Direct Contact with Surface Water
- C-6 Benchmarks for Ingestion

Terrestrial Receptors (Plants & Soil Organisms)

- C-7 Benchmarks for Direct Contact with Surface Soils

Wildlife Receptors (Birds & Mammals)

- C-8 Dose-Based Ingestion Toxicity Reference Values

Aquatic Receptors (Fish & Benthic Macroinvertebrates)

C-1 Benchmarks for Direct Contact with Surface Water

Toxicity values for the protection aquatic life from contaminants in surface water are available from several sources. Each of these sources is described briefly below.

National Ambient Water Quality Criteria

The USEPA has established acute and chronic National Ambient Water Quality Criteria (NAWQC) values for surface waters for the protection of aquatic communities (USEPA 2002a). The acute NAWQC is intended to protect against short-term (48 to 96 hour) lethality, while the chronic NAWQC is intended to protect against long-term effects on growth, reproduction, and survival. The NAWQC values are not species-specific, but are designed to protect 95% of the aquatic species for which toxicity data are available (USEPA 1985).

Great Lake Water Quality Initiative Tier II Values

The approach used for the derivation of Great Lake Water Quality Initiative (GLWQI) Tier II secondary acute values (SAVs) and secondary chronic values (SCVs) is similar to that used to derive NAWQC. Data and detailed methods and are described in Appendix B of Suter and Tsao (1996). In brief, a secondary acute value is derived by taking the lowest genus mean acute value (GMAV) and dividing it by the Final Acute Value Factor (FAVF). The FAVF is based on the number of studies and types of species used to derive the FAV. Once an SAV is calculated, the geometric mean of each of the secondary acute-chronic ratios (SACR) is found. The SCV is calculated by dividing the SAV by the SACR.

USEPA Region 4 Screening Values

Screening level freshwater benchmarks for are also available from USEPA Region 4 (USEPA, 2002b). The Region 4 acute and chronic screening values are equal to the lowest effect level (LEL) divided by 10 to protect for sensitive species. If no chronic LEL is available, the chronic screening value is equal to the lowest acute LC50 or EC50 divided by 10.

Canadian Water Quality Guidelines

The Canadian Council of Ministers of the Environment (CCME) have established water quality guidelines (WQG) for the protection of aquatic life in Canadian waters (CCME, 1991, 2001). The protocol for deriving water quality guidelines is similar to the NAWQC procedure. Protocol details are available on the CCME WQG website. In

brief, the guideline is equal to the most sensitive LOEL from a chronic exposure study divided by a safety factor of 10. If a chronic LOEL is not available, the WQG is equal to the acute LC50 divided by the acute/chronic ratio (ACR). The CCME WQG is designed to be protective of "100% of the aquatic life species, 100% of the time".

Oak Ridge National Laboratory Lowest Chronic Values and EC20 Values

Oak Ridge National Laboratory (ORNL) has compiled summary tables of the lowest chronic values (LCVs) in surface water for fish, daphnids, non-daphnid invertebrates, aquatic plants, and aquatic populations (Suter and Tsao, 1996). In some instances, the LCVs were extrapolated from LC50 and EC50 data using fish and daphnid-specific equations. ORNL also summarized EC20 data for fish, daphnids, sensitive species, and aquatic populations. The EC20s are based on a level of biological effect and are intended to be indices of population production (Suter and Tsao, 1996).

USEPA Region 5 Ecological Screening Levels

The USEPA Region 5 has derived ecological screening levels (ESLs) for RCRA Appendix IX Hazardous Constituents in soil, surface water, sediment, and air (USEPA 1999). The surface water ESL is based on either an aquatic benchmark, which is protective of direct contact exposures, or a wildlife receptor-specific benchmark, which is protective of ingestion exposures in the mink and belted kingfisher. The surface water ESL does not distinguish whether it is derived based on aquatic or wildlife exposure.

OSWER Ecotox Thresholds

The OSWER Ecotox Thresholds (ETs) were presented in a USEPA ECO Update Bulletin (USEPA, 1996). The bulletin provided an overview of the development and use of ecological benchmarks for surface water and sediment. For surface water, the ET is based on either the chronic NAWQC or the GLWQI Tier II value.

Because the USEPA Region 5 ESLs do not make a distinction between surface water benchmarks derived from aquatic data and wildlife data, these values are excluded from consideration as a benchmark source. The OSWER ETs were also excluded because they are based on primary sources (NAWQC, GLWQI Tier II) that had been previously reviewed. For the remaining sources, selection of the surface water toxicity benchmarks for aquatic receptors was based on the following hierarchy:

- National Ambient Water Quality Criteria
- Great Lake Water Quality Initiative Tier II Values
- USEPA Region 4 Screening Values
- Canadian Water Quality Guidelines
- Oak Ridge National Laboratory LCVs and EC20s

The surface water benchmark values from these sources are shown in Table C-1a, along with the values selected for use in the risk assessment. For many metals and metalloids, the NAWQC values are dependent on the hardness of the water, so the precise value of the acute and chronic NAWQC that applies to a sample depends on the hardness of that sample. The equations and parameters used to calculate the acute and chronic NAWQC values for these metals are presented in Table C-1b. The surface water benchmark values for water quality parameters from these sources are shown in Table C-1c.

References:

- Canadian Council of Ministers of the Environment (CCME). 1991. *Appendix IX - A Protocol for the Derivation of Water Quality Guidelines for the Protection of Aquatic Life. April 1991.* In: *Canadian Water Quality Guidelines*, CCME, 1987. Prepared by the Task Force on Water Quality Guidelines. [Updated and reprinted with minor revisions and editorial changes in Canadian Environmental Quality Guidelines, Chapter 4, CCME, 1999, Winnipeg.]
http://www.ec.gc.ca/ceqq-rcqe/English/Pdf/water_protocol-aquatic_life.htm
- Canadian Council of Ministers of the Environment (CCME). 2001. *Canadian Water Quality Guidelines, Summary Table - Updated.* In: *Canadian Environmental Quality Guidelines, 1999*, CCME, Winnipeg. http://www.ec.gc.ca/ceqq-rcqe/English/Pdf/water_summary_table-aquatic_life.htm
- Suter II, GW and CL Tsao. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision.* Oak Ridge National Laboratory. Document # ES/ER/TM-96/R2. June 1996.
- US Environmental Protection Agency (USEPA). 1985. *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses. NTIS Document Number PB85-227049.* US Environmental Protection Agency, Office of Research and Development.
- US Environmental Protection Agency (USEPA). 1996. *ECO Update: Ecotox Thresholds. Intermittent Bulletin. Volume 3, Number 2*, January 1996. EPA 540/F-95/038.
- US Environmental Protection Agency (USEPA). 1999. *Region 5 Ecological Screening Levels for RCRA Appendix IX Hazardous Constituents.* Working Draft 1999. United States Environmental Protection Agency, Region 5.
- US Environmental Protection Agency (USEPA). 2002a. *National Recommended Water Quality Criteria: 2002.* United States Environmental Protection Agency, Office of Water, Office of Science and Technology. November 2002. EPA-822-R-02-047.

US Environmental Protection Agency (USEPA). 2002b. *Region 4 Ecological Risk Assessment Bulletins - Supplement to RAGS*. Downloaded on July 15, 2002 from website:
<http://www.epa.gov/region04/waste/ots/ecolbul.htm>

C-2 Benchmarks for Direct Contact with Sediment

Toxicity values for the protection benthic macroinvertebrates from contaminants in freshwater sediment are available from several sources. Each of these sources is described briefly below.

Consensus-Based Sediment Quality Guidelines

MacDonald et al. (2000) issued consensus-based sediment quality guidelines (SQGs) for 28 chemicals of concern, in an effort to focus on agreement among the various sediment quality guidelines. For each chemical of concern, a threshold effect concentration (TEC) and a probable effect concentration (PEC) were identified based on available sediment toxicity literature. The consensus-based TECs were calculated by determining the geometric mean of all threshold effect values from the literature. The consensus-based PECs were calculated by determining the geometric mean of all probable effect values from the literature. A summary of the types of sediment effect concentrations included in the TEC and PEC calculations is provided in MacDonald et al. (2000).

The predictive reliability of these values were also evaluated. The predictive ability analyses were focused on the ability of each SQG when applied alone to classify samples as either toxic or non-toxic. Sediment toxicity should be observed only rarely below the TEC and should be frequently observed above the PEC. Individual TECs were considered reliable if more than 75% of the sediment samples were correctly predicted to be non-toxic. Similarly, the individual PEC was considered reliable if greater than 75% of the sediment samples were correctly predicted to be toxic. The SQGs were considered to be reliable only if a minimum of 20 samples were included in the predictive ability evaluation (MacDonald et al. 2000).

Because field collected sediments contain a mixture of chemicals, a second analysis was completed to investigate whether the toxicity of a sediment could be predicted based on the average of the PEC ratios for the sediment, using only the PEC values that were found to be reliable. It was found that 92% of sediment samples with a mean PEC quotient > 1.0 were toxic to one or more species of aquatic organisms. The mean PEC quotient was found to be highly correlated with incidence of toxicity ($R^2 = 0.98$) (MacDonald et al. 2000).

ARCS Sediment Effect Concentrations

As part of the Assessment and Remediation of Contaminated Sediment (ARCS) Project, Ingersoll et al. (1996) compiled freshwater sediment toxicity data from nine different sites in the United States and identified a series of sediment effect concentrations (SECs) for a series of metals in sediment. The SECs are defined as the concentrations of individual contaminants in sediment below which toxicity is rarely observed and above which toxicity is frequently observed. The database was compiled to classify toxicity

data for Great Lakes sediment samples and is segregated into “effect” data and “no effect” data. Ingersoll et al.(1996) derived five different SECs; effect range low (ERL), effect range median (ERM), threshold effect level (TEL), probable effect level (PEL) and no effect concentration (NEC). The derivation of each of these SECs is presented below:

effect range low (ERL) = 10th percentile of adverse effect data
effect range median (ERM) = 50th percentile (median) of adverse effect data
no effect range median (NERM) = 50th percentile (median) of no effect data
no effect range high (NERH) = 85th percentile of no effect data
threshold effect level (TEL) = geometric mean of ERL and NERM
probable effect level (PEL) = geometric mean of ERM and NERH
no effect concentration (NEC) = maximum of no effect data

The ERL is defined as the concentration below which adverse effects are unlikely to occur. The ERM is defined as the concentration of a chemical above which effects are frequently or always observed or predicted among most species. The NEC is the maximum concentration of a chemical in sediment that does not significantly adversely affect the particular response when compared to the control.

USEPA Region 5 Ecological Screening Levels

The USEPA Region 5 Ecological Screening Levels (ESLs) for sediment were developed based on available federal freshwater sediment criteria and state-promulgated sediment quality guidelines (USEPA 1999). If no freshwater guidelines were available, marine criteria were used. For those chemicals for which no guidelines were available, an interim ESL was developed using the equilibrium partitioning approach. These interim guidelines were developed for both nonpolar and polar organic constituents. The equilibrium partitioning method is generally only applied to nonpolar organics, however, it was assumed to be a satisfactory method for organics for use on a screening level approach (USEPA 1999). The ESL was derived from the lowest federal, state or interim water quality guideline and assumes a total organic carbon content of 1%.

NOAA Sediment Effect Concentrations

The National Oceanic and Atmospheric Administration (NOAA) compiled sediment data from studies performed in both freshwater and saltwater (originally presented in NOS OMA Technical Memo 52, Long and Morgan 1990).The NOAA ERL and ERM were developed using the same procedures as outlined for the ARCS Project (Ingersoll et al. 1996). The NOAA ERL is defined as the concentration of a chemical in sediment below which adverse effects are rarely observed or predicted among sensitive species. The NOAA ERM is representative of concentrations above which effects frequently occur. The original data set used by Long and Morgan (1990) has since been supplemented with additional saltwater data, therefore these additional marine reports are not applicable (ie:

Long et al. 1995).

USEPA Region 4 Screening Levels

The USEPA Region 4 Screening Levels are derived from three different sediment effects data sets including NOAA freshwater and marine data from Long and Morgan (1990), additional NOAA marine data from Long et al. (1995), and Florida State Department of Environmental Protection marine data from MacDonald et al. (1996). The sediment effect level is based on the reported ERL from each study. In instances when the USEPA Contract Laboratory Program (CLP) practical quantitation limit (PQL) is above the effect level, the screening value is equal to the CLP PQL (USEPA 2002).

CCME Sediment Quality Guidelines

The Canadian Council of Ministers of the Environment (CCME) derived sediment quality guidelines to support protection and management strategies for freshwater, estuarine, and marine ecosystems (CCME 1995). Guideline derivation protocols are detailed in CCME (1995) and are similar to the procedures described previously for the ARCS Project (Ingersoll et al. 1996). Separate guidelines were derived for freshwater and marine sediments (CCME 2001). The freshwater interim sediment quality guideline (ISQG) was equal to the TEL and is representative of the concentration below which adverse effects are not anticipated for aquatic life associated with bed sediments (CCME 1995). A PEL was also calculated to establish concentrations above which adverse effects are likely to occur.

Ontario Sediment Effect Levels

Persaud et al. (1993) derived sediment effect levels for the protection of aquatic organisms in Ontario, Canada. Three types of sediment quality guidelines were developed; a No Effect Level (no toxic effects), a Low Effect Level (tolerable by benthic species), and a Severe Effect Level (detrimental to most benthic species). A summary and review of the available approaches to sediment guideline development and the protocol for the derivation of the Ontario values is described in detail in Persaud et al. (1993). Briefly, the No Effect Level is obtained through a chemical equilibrium approach using water quality standards. Because the equilibrium partitioning approach is only predictive for nonpolar organics, a No Effect Level is not derived for metals and polar organics. The Low Effect Level and Severe Effect Level are based on the 5th and 95th percentiles of all effects data for bulk sediment analysis, respectively. For non-polar organics these concentrations were normalized for total organic carbon.

Oak Ridge National Laboratory Equilibrium Partitioning Guidelines

Oak Ridge National Laboratory (ORNL) has compiled summary tables of the lowest chronic values (LCVs) in surface water for fish, daphnids, and non-daphnid invertebrates for nonionic organics (see Section B-1). Using on these values, sediment equilibrium partitioning (EqP) guidelines were calculated based on the chemical K_{oc} and normalizing to 1% total organic carbon (Jones et al. 1997). Secondary chronic values (SCVs), intended to be conservative predictors of effects, were also calculated using the same EqP approach.

Of these sources, the following are excluded from use in this risk assessment due to inadequate documentation of derivation methodology, use of site-specific assumptions, use of marine or estuarine sediments, use of inappropriate receptors, or errors in benchmark derivation.

USEPA Region 5 Screening Levels
USEPA Region 4 Screening Levels
CCME Sediment Quality Guidelines (ISQG/PEL)
Ontario Sediment Effect Levels (Low/Severe)
ORNL EqP Guidelines

Of the remaining sources, a benchmark selection hierarchy is established as follows and a summary of all selected sediment toxicity benchmarks is shown in Table C-2.

Consensus based TEC (MacDonald et al., 2000)
ARCs TEL (Ingersoll et al., 1996)
NOAA ERL (Long and Morgan, 1990)

References:

Canadian Council of Ministers of the Environment (CCME). 1995. *Protocol for the Derivation of Canadian Sediment Quality Guidelines for the Protection of Aquatic Life*. CCME EPC-98E. Prepared by Environment Canada, Guidelines Division, Technical Secretariat of the CCME Task Group on Water Quality Guidelines, Ottawa. [Reprinted in Canadian Environmental Quality Guidelines, Chapter 6, CCME, 1999, Winnipeg.]

Canadian Council of Ministers of the Environment (CCME). 2001. *Canadian Sediment Quality Guidelines for the Protection of Aquatic Life: Summary Tables - Updated*. In: Canadian Environmental Quality Guidelines, CCME, 1999, Winnipeg.

Jones, DS, GW Suter II, RN Hull. 1997. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Dwelling Biota: 1997 Revision*. Oak Ridge National Laboratory. Document # ES/ER/TM-95/R4.

Long, ER and LG Morgan. 1990. *The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program*. National Oceanic and Atmospheric Administration Publication. Technical Memorandum NOS OMA 52. March 1990.

Long, ER, DD MacDonald, SL Smith, FD Calder. 1995. Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management 19(1):81-97.

MacDonald, DD, RS Carr, FD Calder, ER Long, CG Ingersoll. 1996. Development and Evaluation of Sediment Quality Guidelines for Florida Coastal Waters. *Ecotoxicology* 5:253-278.

MacDonald, DD, CG Ingersoll and TA Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. *Archives of Environmental Contamination and Toxicology* 39:20-31.

Persaud, D, R Jaagumagi, H Hayton. 1993. *Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario*. Ontario Ministry of the Environment, Waster Resources Branch, Toronto. August 1993. ISBN 0-7729-9248-7.

US Environmental Protection Agency (USEPA). 2002. *Region 4 Ecological Risk Assessment Bulletins - Supplement to RAGS*. Downloaded on July 15, 2002 from website:
<http://www.epa.gov/region04/waste/ots/ecolbul.htm>

Amphibians

Screening-level toxicity benchmarks for the protection of amphibians were identified using the U.S. EPA Ecotoxicology (ECOTOX) database (<http://cfpub.epa.gov/ecotox/>) and the Database of Reptile and Amphibian Toxicology Literature (RATL) developed by Environment Canada (Pauli et al., 2000).

C-5 Benchmarks for Direct Contact with Surface Water

Most of the available toxicity information was based on studies performed to evaluate direct contact exposure with surface water. In most cases, available toxicity data were LC50 values (the test concentration lethal to 50% of the test population) derived from short-term exposure studies. To estimate a screening-level toxicity benchmark value, the lowest LC50 from the database was divided by a factor of ten.

Table C-5 provides the selected toxicity benchmarks for amphibians. It should be noted that these benchmarks should be interpreted as screening-level values that do not account for site-specific factors which may either increase or reduce toxicity.

C-6 Benchmarks for Ingestion

Few studies provide information on amphibian toxicity from oral exposure studies. Available data appear to be limited to cadmium and lead (Pauli et al., 2000). To the extent feasible, data from applicable studies will be used to provide a screening-level assessment of potential risks to amphibians from ingestion exposures.

References:

Pauli, B.D., J.A. Perrault and S.L. Money. 2000. *RATL: A Database of Reptile and Amphibian Toxicology Literature*. Technical Report Series No. 357. Canadian Wildlife Service, Headquarters, Hull, Québec, Canada. <http://dsp-psd.pwgsc.gc.ca/Collection/CW69-5-357E.pdf>

Terrestrial Receptors (Plants & Soil Invertebrates)

C-7 Benchmarks for Direct Contact with Surface Soils

Toxicity values for the protection aquatic life from contaminants in surface soils are available from several sources. Each of these sources is described briefly below.

Ecological Soil Screening Levels (Eco-SSLs). Eco-SSLs are concentrations of contaminants in soils that are protective of ecological receptors that commonly come into contact with soil or ingest biota that live in or on soil. The Eco-SSLs are screening values that can be used routinely to identify those contaminants of potential concern (COPCs) in soils requiring further evaluation in a baseline ecological risk assessment (ERA). Eco-SSLs are derived separately for four groups of ecological receptors, plants, soil invertebrates, birds and mammals. As such, these values are presumed to provide adequate protection of terrestrial ecosystems. The lower of the values for plants and soil invertebrates is used preferentially as the Eco-SSL.

The Eco-SSL derivation process represents a three year collaborative effort of a multi-stakeholder workgroup consisting of federal, state, consulting, industry and academic participants led by the USEPA, Office of Emergency and Remedial Response (OERR) (USEPA, 2002b). The USEPA will issue the final guidance for Eco-SSLs and interim final Eco-SSL values for several contaminants in 2003.

Oak Ridge National Laboratory Plants/Soil Organisms/Microbes

Oak Ridge National Laboratory (ORNL) reviewed data on the toxicity of contaminants in soil on a wide range of plants, soil organisms, and microbes, and determined the lowest observed effect concentration (LOEC) (Efroymson et al. 1997a,b) . The LOEC is defined as the lowest applied concentration of the chemical causing a greater than 20% reduction in the measured response. In some cases, the LOEC is the lowest concentration tested or the only concentration reported (EC50 or ED50 data). The LOECs for a series of different plants and soil organisms are rank ordered and a value selected that approximated the 10th percentile. When a benchmark is based on a lethality endpoint, the benchmark value is divided by 5 to approximate an effects concentration for growth and reproduction. The factor is selected based on the author's judgment (Efroymson et al. 1997a,b). The benchmark values are then rounded to one significant figure.

Dutch Target and Intervention Values

The Dutch Target and Intervention Values are derived from available data on ecotoxicological effects of contaminants in soil to terrestrial species and soil microbial processes (Swartjes 1999). The Target Values for soil are related to negligible risk for soil ecosystems (95% protection). The Intervention Values are defined as the hazardous

concentration for 50% of the soil ecosystem population and are not protective of sensitive species. The Dutch benchmarks are developed by reviewing available literature to determine the lowest no observed effect concentration (NOEC). When there is a LOEC but no NOEC, the NOEC is estimated from the LOEC according to the effect level observed at the LOEC, as follows:

LOEC Effect Range	NOEC
10% - 20%	LOEC / 2
20% - 50%	LOEC / 3
50% - 80%	LOEC / 10

The ecotoxicological data are selected according to the criteria established in Crommenentuin et al. (1994) and are normalized for soil characteristics such as organic matter and clay content. If not enough data is available for terrestrial species and microbial processes, aquatic data (adjusted by an uncertainty factor of 10) are used to derive the benchmark values (Swartjes 1999).

CCME Soil Quality Guidelines

The Canadian Council of Ministers of the Environment (CCME) established effects-based environmental soil quality guidelines (SQ_E) designed to be clean-up goals to protect ecological receptors from direct contact and ingestion exposures to soil-based contaminants. From the available soil toxicity literature, CCME compiled an adverse effect data set and a no effect data set. Several SQ_{Es} are calculated based on land use types (agricultural-A, residential/parkland-R/P, commercial/industrial-C/I). Based on the amount of toxicity data available, different derivation methods are used to calculate the land use SQ_E. Each of these methods are detailed in CCME (1999) and described briefly below.

Weight-of Evidence Method

A, R/P Land Uses = threshold effects concentration (TEC), 25th percentile of effect and no effect data sets divided by an uncertainty factor

C/I Land Use = effects concentration low (ECL), 25th percentile of effect data set

Lowest-Observed-Effect Concentration (LOEC) Method

A, R/P Land Uses = lowest available LOEC divided by an uncertainty factor

C/I Land Use = geometric mean of available LOEC data

Median Effects Method

A, R/P Land Uses = lowest available EC50 or LC50 divided by an uncertainty factor

C/I Land Use = no guideline calculated

In addition to calculating an SQG_E , CCME also derived SQGs for human health (SQG_{HH}). The final soil guideline is the minimum of the SQG_E and the SQG_{HH} .

USEPA Region 4 Ecological Screening Levels

The USEPA Region 4 compiled soil toxicity screening benchmarks from several sources including ORNL (Efroymson et al. 1997a,b), CCME (CCME 1997), and Dutch values (Crommenentuin et al. 1994). From these sources, screening levels are selected based on contaminant levels associated with ecological effects (USEPA 2002b). These screening values do not take into account area or regional background levels.

USEPA Region 5 Ecological Screening Levels

The USEPA Region 5 reviewed and evaluated soil quality criteria from international, federal, and state sources (USEPA 1999). A default soil ecological screening level (ESL) is selected based on the lowest receptor-specific ESL for terrestrial (plant/soil organisms) and wildlife receptors found during a review of existing toxicological information. The ESL is derived from the concentration which resulted in no observed adverse effects (NOAEL) for chronic exposure of the target species. When a chronic value is not available, the most relevant toxicological result is adjusted by division with uncertainty factors as appropriate to approximate the chronic NOAEL for the selected receptor (USEPA 1999).

Because the CCME final SQGs do not make a distinction between ecological and human health benchmarks, they are not included as a benchmark source. Because the USEPA Region 5 ESLs do not make a distinction between soil benchmarks derived from plant/soil organism data and wildlife data, these values are excluded from consideration as a benchmark source. The Region 4 benchmarks are also excluded because they are based on primary sources that had been previously reviewed. For the remaining sources, selection of the surficial soil toxicity benchmarks for terrestrial receptors is based on the following hierarchy:

Minimum of the Eco-SSLs for plants and soil invertebrates

Minimum of the ORNL plant, soil organism, microbe benchmarks

The soil benchmark values for all chemicals analyzed in surface soils are shown in Table C-6.

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Table C-1a
Surface Water Toxicity Benchmarks for Aquatic Receptors

Analyte	ACUTE				CHRONIC				
	NAWQC - Acute (ug/L) ¹	GLWQI Tier II SAV (ug/L) ²	USEPA R4 Acute (ug/L) ²	Surface Water Acute Benchmark (ug/L)	NAWQC - Chronic (ug/L) ¹	GLWQI Tier II SCV (ug/L) ²	USEPA R4 - Chronic (ug/L) ²	Other (ug/L) ²	Surface Water Chronic Benchmark (ug/L)
Aluminum	750	6	--	750	750	87	--	87	--
Antimony	--	180	1300	180	--	30	160	--	30
Arsenic	340	9, 10	--	360	340	150	9, 10	--	150
Barium	50,000	8	110	--	50,000	5,000	3	--	--
Beryllium	--	35	16	35	--	0.66	0.53	--	0.66
Boron	--	30	--	30	--	1.6	-- ¹³	8,830 LCV Daphnids	1.60
Cadmium	0.8	4, 10	--	3.92	0.83	0.13	4, 10	--	0.13
Calcium	--	--	--	no benchmark	--	--	--	116,000 LCV Daphnids	116000
Chromium III	269	4, 10	--	1,740	269	35	4, 10	--	35
Chromium VI	16	10	--	16	16	10.6	10	--	11
Cobalt	--	1,500	--	1,500	--	23	--	--	23
Copper	BLM	14		BLM	BLM	14			BLM
Cyanide	22	12	--	22	22	5.2	12	--	5.2
Iron	--	--	--	no benchmark	1,000	--	1,000	300 CCME WQG	1,000
Lead	24	4, 10	--	81.6	24	0.92	4, 10	--	0.9
Lithium	--	260	--	260	--	14	--	--	14
Magnesium	--	--	--	no benchmark	--	--	--	82,000 LCV Daphnids	82,000
Manganese	--	2,300	--	2,300	--	120	--	--	120
Mercury	1.2	--	2.4	1.2	0.65	1.3	0.012	--	0.65
Molybdenum	--	16,000	--	16,000	--	370	--	--	370
Nickel	216	4, 10	--	1420	216	24.0	4, 10	--	24.0
Phosphorus	--	--	--	no benchmark	--	--	--	--	no benchmark
Potassium	--	--	--	no benchmark	--	--	--	53,000 LCV Daphnids	53,000
Selenium	--	--	20	20	5.0	11	--	5.0	--
Silica	--	--	--	no benchmark	--	--	--	--	no benchmark
Silver	0.7	4, 10	--	4.1	0.7	0.1	3	0.36	0.012
Sodium	--	--	--	no benchmark	--	--	--	680,000 LCV Daphnids	680,000
Strontium	--	15,000	--	15,000	--	1,500	--	--	1,500
Sulfide	--	--	--	no benchmark	2.0	--	--	--	2.0
Sulfur	--	--	--	no benchmark	--	--	--	--	no benchmark
Thallium	--	110	140	110	--	12	4	--	12
Vanadium	--	280	--	280	--	20	--	--	20
Zinc	54	4, 10	--	117	54	54	4, 10	--	54

1 USEPA, 2002. National Recommended Water Quality Criteria: 2002. November 2002. EPA 822-R-02-047.

2 Suter & Tsao, 1996.

3 Only acute NAWQC available; chronic NAWQC is equal to acute / 10.

4 Metal toxicity is hardness-dependent; values shown are calculated based on a hardness of 40 mg/L.

5 National Irrigation Water Quality Program (1998)

6 Aluminum NAWQC apply to waters with pH of 6.5 - 9.0.

7 Alkalinity NAWQC is the minimum required value.

8 Based on USEPA Gold Book value.

9 NAWQC derived from data for As 3+, but is applied here to total arsenic.

10 NAWQC expressed in terms of the dissolved fraction.

11 NAWQC is based on whole body fish tissue levels.

12 NAWQC expressed in terms of free cyanide.

13 Region 4 value based on minimum standard for long-term irrigation of sensitive crops.

14 NAWQC recommends use of the Biotic Ligand Model (BLM) to assess toxicity.

NAWQC = National Ambient Water Quality Criteria

GLQWI = Great Lakes Water Quality Initiative

SAV/SCV = Secondary Acute/Chronic Value

CCME = Canadian Council of Ministers of the Environment

WQG = Water Quality Guidelines

LCV = Lowest Chronic Value

Table C-2
Bulk Sediment Toxicity Benchmarks for Benthic Macroinvertebrates

Analyte	Threshold Effect Concentrations (TEC) ¹				Probable Effect Concentrations (PEC) ²			
	Consensus-Based TEC (mg/kg) ^a	ARCS TEL (mg/kg) ^b	Other (mg/kg)	Sediment Screening Benchmark (mg/kg)	Consensus-Based PEC (mg/kg) ^a	ARCS PEL (mg/kg) ^b	Other (mg/kg)	Sediment Screening Benchmark (mg/kg)
Aluminum	--	25,519	--	25,519	--	59,572	--	59,572
Antimony	--	--	2.0	NOAA ERL ^c	2.0	--	25.0	NOAA ERM ^c
Arsenic	9.8	11	--		9.8	33.0	48.0	--
Barium	--	--	--		no benchmark	--	--	no benchmark
Beryllium	--	--	--		no benchmark	--	--	no benchmark
Cadmium	0.99	0.58	--		1.0	4.98	3.2	--
Calcium	--	--	--		no benchmark	--	--	no benchmark
Chromium	43	36	--		43	111	120	--
Cobalt	--	--	--		no benchmark	--	--	no benchmark
Copper	32	28	--		32	149	100	--
Cyanide	--	--	--		no benchmark	--	--	no benchmark
Iron	--	188,400	--		188,400	--	247,600	--
Lead	36	37	--		36	128	82.0	--
Magnesium	--	--	--		no benchmark	--	--	no benchmark
Manganese	--	631	--		631	--	1,184	--
Mercury	0.18	--	--		0.18	1.06	--	--
Nickel	23	20	--		23	48.6	33	--
Potassium	--	--	--		no benchmark	--	--	no benchmark
Phosphorus	--	--	--		no benchmark	--	--	no benchmark
Selenium	--	--	--		no benchmark	--	--	no benchmark
Silver	--	--	1.0	NOAA ERL ^c	1	--	3.7	NOAA ERM ^c
Sodium	--	--	--		no benchmark	--	--	no benchmark
Sulfide	--	--	--		no benchmark	--	--	no benchmark
Thallium	--	--	--		no benchmark	--	--	no benchmark
Vanadium	--	--	--		no benchmark	--	--	no benchmark
Zinc	121	98	--		121	459	540	--
								459

Notes:

1 The TEC encompasses several types of sediment quality guidelines including the Lowest Effect Level (LEL), the Threshold Effect Level (TEL), the Effect Range Low (ERL), the TEL for *Hyalella azetca* in 28 day tests (TEL-HA28), and the Minimum Effect Threshold (MET).

2 The PEC encompasses several types of sediment quality guidelines including the Severe Effect Level (SEL), the Probable Effect Level (TEL), the Effect Range Median (ERM), the PEL for *Hyalella azetca* in 28 day tests (PEL-HA28), and the Toxic Effect Threshold (TET).

Sources Hierarchy:

a MacDonald et al. (2000); consensus-based threshold effect concentration (TEC) and probable effect concentration (PEC).

b Ingersoll, et al. (1996); Threshold Effect Level (TEL) and Probable Effect Level (PEL) for total extraction of sediment (BT) samples from *Hyalella azetca* 28-day

c Long and Morgan (1990); NOAA Effect Range Low (ERL) and Effect Range Median (ERM).

Table C-5
Screening-Level Toxicity Benchmarks for Amphibians from Aqueous Exposures

Analyte	Species	Endpoint	Exposure Duration	Source	Lowest Value (ug/L)	Aqueous Screening Benchmark (ug/L)
Aluminum	Eastern Narrow-Mouthed Toad (<i>Gastrophryne carolinensis</i>)	LC50	7 days	Birge (1978)	50	5
Antimony	Eastern Narrow-Mouthed Toad (<i>Gastrophryne carolinensis</i>)	LC50	7 days	Birge (1978) & Birge et al. (1979)	300	30
Arsenic	Eastern Narrow-Mouthed Toad (<i>Gastrophryne carolinensis</i>)	LC50	7 days	Birge (1978) & Birge et al. (1979)	40	4.0
Beryllium	Spotted & Marbled Salamander (<i>Ambystoma</i> sp.)	LC50	2 - 4 days	Slonim and Ray (1975)	3150	315
Cadmium	Eastern Narrow-Mouthed Toad (<i>Gastrophryne carolinensis</i>)	LC50	7 days	Birge et al. (1979)	40	4.0
Chromium	Eastern Narrow-Mouthed Toad (<i>Gastrophryne carolinensis</i>)	LC50	7 days	Birge (1978) & Birge et al. (1979)	30	3.0
Cobalt	Eastern Narrow-Mouthed Toad (<i>Gastrophryne carolinensis</i>)	LC50	7 days	Birge (1978) & Birge et al. (1979)	50	5.0
Copper	Eastern Narrow-Mouthed Toad (<i>Gastrophryne carolinensis</i>)	LC50	7 days	Birge et al. (1979)	40	4.0
Lead	Eastern Narrow-Mouthed Toad (<i>Gastrophryne carolinensis</i>)	LC50	Not Reported	Birge et al. (1979)	40	4.0
Manganese	Eastern Narrow-Mouthed Toad (<i>Gastrophryne carolinensis</i>)	LC50	7 days	Birge (1978) & Birge et al. (1979)	1420	142
Mercury	Eastern Narrow-Mouthed Toad (<i>Gastrophryne carolinensis</i>)	LC50	7 days	Birge et al. (1979)	1	0.1
Nickel	Eastern Narrow-Mouthed Toad (<i>Gastrophryne carolinensis</i>)	LC50	7 days	Birge (1978) & Birge et al. (1979)	50	5.0
Selenium	Eastern Narrow-Mouthed Toad (<i>Gastrophryne carolinensis</i>)	LC50	7 days	Birge (1978) & Birge et al. (1979)	90	9.0
Silver	Eastern Narrow-Mouthed Toad (<i>Gastrophryne carolinensis</i>)	LC50	7 days	Birge (1978)	10	1.0
Zinc	Eastern Narrow-Mouthed Toad (<i>Gastrophryne carolinensis</i>)	LC50	7 days	Birge et al. (1979)	10	1.0

Lowest exposure concentration selected for screening benchmark.

Mercury benchmark is based on inorganic mercury.

For lethality endpoints, Screening Benchmark = LC50 / 10

Source: ECOTOX Database, RATL Database

Source Citations:

Birge, W.J. 1978. Aquatic Toxicology of Trace Elements of Coal and Fly Ash. In: J H Thorp and J W Gibbons (Eds.), Department of Energy Symposium Series, Energy and Environmental Stress in Aquatic Systems, Augusta, GA. 48:219-240.

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Table C-6
Soil Toxicity Benchmarks for Terrestrial Receptors (Plants & Soil Organisms)

Analytes	EcoSSL Plants (mg/kg dw)	ORNL Plants (mg/kg dw)	Plant Screening Level Benchmark (mg/kg)	EcoSSL Invertebrates (mg/kg dw)	ORNL Invertebrates (mg/kg dw)	ORNL Microbes (mg/kg dw)	Soil Organism Screening Level Benchmark (mg/kg)	Lowest Screening Level Benchmark (mg/kg)
Aluminum	--	50	50	--	--	600	600	50
Antimony	--	5.0	5.0	78	--	--	78	5
Arsenic	31	10	31	--	60	100	60	31
Cadmium	28	4.0	28.0	150	20	20.0	150	28
Calcium	--	--	no benchmark	--	--	--	no benchmark	no benchmark
Chromium	--	1.0	1.0	--	0.4	10.0	0.4	0.4
Cobalt	32	20	32	--	--	1000	1,000	32
Copper	95	100	95	54	50	100	54	54
Iron	--	--	no benchmark	--	--	200	200	200
Lead	210	50	210	1700	500	900	1,700	210
Magnesium	--	--	no benchmark	--	--	--	no benchmark	no benchmark
Manganese	152	500	152	450	--	100	450	152
Mercury	--	0.3	0.3	--	0.1	30	0.1	0.1
Nickel	48	30	48	--	200	90	90	48
Potassium	--	--	no benchmark	--	--	--	no benchmark	no benchmark
Silver	--	2.0	2.0	--	--	50.0	50.0	2.0
Sodium	--	--	no benchmark	--	--	--	no benchmark	no benchmark
Zinc	130	50	130	120	100	100	120	120